Spiorad na Mara Offshore Wind Farm

Offshore Project

Environmental Impact Assessment Report

Chapter 11: Benthic and Intertidal Ecology, Volume 2a

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11.1 INTRODUCTION

11.1.1 OVERVIEW

11.1.1.1 This chapter of the Environmental Impact Assessment Report (EIAR) presents the results of the assessment of the likely significant effects of the proposed Spiorad na Mara Offshore Wind Farm (hereafter referred to as 'the Offshore Project') with respect to Benthic and Intertidal Ecology, which includes shellfish, benthic infauna and benthic epifauna.

11.1.1.2 This chapter should be read in conjunction with the project description provided in **Chapter 3: Project Description, Volume 1a** and the relevant parts of the following chapters and appendices:

- **Chapter 9: Physical and Coastal Processes, Volume 2a** (Changes to marine geology, oceanography and physical processes have the potential to directly or indirectly impact ecological benthic and intertidal receptors by altering sediment, water and habitat quality;
- **Chapter 10: Marine Sediment and Water Quality, Volume 2a** (Changes in marine water and sediment quality have the potential to result in adverse effects on ecological benthic and intertidal receptors through toxicity and alterations to habitat quality);
- **Chapter 12: Fish Ecology, Volume 2a** (Benthic and intertidal species could indirectly impact fish as they provide a food source for several fish species and any changes to benthic habitat structure could also impact indirectly on fish populations through changes in the provision of suitable habitat for shelter, spawning and nursing;
- **Chapter 13: Marine Mammals, Volume 2a** (Benthic and intertidal species indirectly support marine mammal species via their role in the food web and ecosystem processes and therefore impacts to benthic and intertidal communities and species could potentially indirectly impact marine mammals);
- **Chapter 21: Commercial Fisheries, Volume 2a** (Benthic and intertidal species comprise part of the diet for several fish species or indirectly support fish species via their role in the food web and ecosystem processes and therefore impacts to benthic and intertidal communities could potentially indirectly impact commercial fisheries);
- **Appendix 13.3: Underwater Noise Modelling, Volume 2c** (Shellfish and benthic species that are sensitive to noise have the potential to be negatively impacted by underwater noise generated from the construction phase and therefore results from the underwater noise modelling have informed the impact assessment).

11.1.1.3 This technical chapter describes the following:

- Legislation, planning policy and other documentation that has informed the assessment (Section 11.2: Summary of policy and legislative context);

- Outcome of consultation and engagement that has been undertaken to date, including how matters relating to Benthic and Intertidal Ecology have been addressed (Section 11.3 : Scoping and consultation);
- Scope of the assessment for Benthic and Intertidal Ecology (Section 11.4: Scope of the assessment);
- The methods of assessment used for baseline data gathering and impact assessment (Section 11.5: Methodology for baseline data gathering and impact assessment);
- Overall baseline (Section 11.6: Baseline conditions);
- Embedded environmental measures relevant to Benthic and Intertidal Ecology and the relevant maximum design scenario (Section 11.7: Basis for Environmental Impact Assessment);
- Assessment of likely Benthic and Intertidal Ecology likely significant effects and further mitigation (Section 11.8-11.10: Assessment of effects and mitigation);
- Assessment of Benthic and Intertidal Ecology Combined effects (Section 11.11: Assessment of combined effects);
- Assessment of Benthic and Intertidal Ecology consideration of onshore transmission works project (Section 11.12: Summary of residual effects);
- Assessment of Benthic and Intertidal Ecology Cumulative effects (Section 11.13)
- Assessment of transboundary effects (Section 11.14);
- A summary of residual effects for Benthic and Intertidal Ecology (Section 11.15: Summary of residual effects);
- Glossary and abbreviations for terminology referred to in this chapter (Section 11.16);
- Information sources and documentation referred to in this chapter (Section 11.17: References).

11.1.1.4 The chapter is supported by the following appendices and figures:

- **Figure 11-1: Offshore Project and Benthic and Intertidal Ecology Study Area, Volume 2b;**
- **Figure 11-2: Designated sites within the vicinity of the Offshore Project Boundary, Volume 2b;**
- **Figure 11-3: EUNIS 2007 habitats located within the vicinity of the Offshore Project Boundary, Volume 2b;**
- **Figure 11-4: EUNIS 2019 habitats located within the vicinity of the Offshore Project Boundary, Volume 2b;**
- **Figure 11-5: EUNIS habitat/biotope mapping across the Offshore Project Boundary from 2024 surveys, Volume 2b;**
- **Figure 11-6: Spatial distribution and extent of Annex I Stony and Bedrock Reef across the Offshore Project Boundary, Volume 2b;**
- **Figure 11-7: Protected habitats and species within the Benthic and Intertidal Ecology Study Area;**
- **Appendix 5.2: Response to EIA Scoping Opinion, Volume 1c;**
- **Appendix 11.1: Subtidal Environmental Baseline Survey: Technical Report, Volume 2c;**
- **Annex 12.1.2: eDNA Report, Volume 2c;**

- **Invasive Non-Native Species Management Plan, Volume 3.**

11.2 SUMMARY OF POLICY AND LEGISLATIVE CONTEXT

11.2.1.1 This section outlines the legislation, policy and guidance that is relevant to the assessment of likely significant effects on Benthic and Intertidal Ecology associated with the construction, operation and maintenance (O&M) and decommissioning of the Offshore Project. In addition, other national, regional, and local policies are considered within this assessment where they are judged to be relevant. Further information on policies relevant to the EIAR is provided in **Chapter 2: Policy and Legislative Context, Volume 1a.**

11.2.1.2 A summary of the legislation, policy, and guidance relevant to Benthic and Intertidal Ecology is provided in **Table 11-1** which examined their relevance to the assessment.

Table 11-1: Legislation, policy, and guidance in relation to Benthic and Intertidal Ecology

Title	Relevance to Benthic and Intertidal Ecology
International Legislation	
Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR) 1992	The OSPAR Convention comprises a series of annexes relevant to the Benthic and Intertidal Ecology assessment: • Annex I-III: Prevention and elimination of pollution from land-based sources, dumping or incineration and other offshore sources; • Annex IV: Assessment of the quality of the marine environment; • Annex V: On the protection and conservation of the ecosystems and biological diversity of the maritime area. The OSPAR Convention is implemented through OSPAR's North-East Atlantic Environment Strategy 2030. Some of the relevant strategic objectives (SO) include: • SO 5: To protect and conserve marine biodiversity, ecosystems and their services to achieve good status of species and habitats and thereby maintain and strengthen ecosystem resilience. The targets include: – S5.O4: By 2025, take appropriate actions to prevent or reduce pressures to enable the recovery of marine species and benthic and pelagic habitats in order to reach and maintain good environmental status as reflected in relevant OSPAR status assessments;

Title	Relevance to Benthic and Intertidal Ecology
	– S5.O5: By 2025, to implement all agreed measures to enable the recovery of OSPAR Listed threatened and/or declining species and habitats and will take additional measures as needed; • SO 6: Restore degraded benthic habitats when practicable to safeguard their ecosystem function and resilience to climate change and ocean acidification. These targets include: – S6.O1: By 2023, identify habitats suitable for restoration, and develop a common knowledge base on the most appropriate and effective methods for restoration of degraded habitats; – S6.02: By 2025, develop a regional approach, including relevant qualitative and/or quantitative targets for restoration of degraded habitats suitable for restoration, and to implement actions to achieve the targets as appropriate; • SO 9: Safeguard the structure and functions of the seabed/marine ecosystems by preventing significant habitat loss and physical disturbance due to human activities. OSPAR has played a primary role in coordinating the implementation of the Marine Strategy Directive (see subsequent Marine Strategy Regulations section).
Convention on Biological Diversity 1992	Established a global framework for conserving biodiversity. The UK's response to this created the Biodiversity Action Plan (BAP), identifying priority species and habitats most at risk. Following this, action plans set out specific measures to conserve and enhance these species and habitats. Subsequent action plans then sought to ensure that priority species or habitats are conserved or enhanced.
The International Convention for the Control and Management of Ships Ballast Water and Sediments (Ballast Water Management Convention) 2004	Invasive aquatic species present a major threat to marine ecosystems, and shipping has been identified as a major pathway for introducing species to new environments. However, the Ballast Water Management Convention, adopted in 2004, aims to prevent the spread of harmful aquatic organisms from one region to another, by

Title	Relevance to Benthic and Intertidal Ecology
	establishing standards and procedures for the management and control of ships' ballast water and sediments. The convention mandates the implementation of a Ballast Water Management Plan, record keeping and compliance with discharge standards.
The Kunming-Montreal Global Biodiversity Framework 2022	The Kunming-Montreal Global Biodiversity Framework built on the Convention on Biological Diversity 1992 by creating a successor Strategic Plan. It commits 196 countries to halting and reversing nature loss by 2030. The agreement's 23 targets include a global target to conserve at least 30% of the world's ocean by 2030 ("30x30").
The Regulation on Nature Restoration (Nature Restoration Law) 2024	The European Union (EU) adopted a new "Nature Restoration Law" on 18 August 2024. Member States will put in place restoration measures in at least 20% of the EU's sea areas by 2030. The regulation sets binding targets to restore degraded ecosystems, particularly those with the most potential to capture and store carbon and to prevent and reduce the impact of natural disasters. Full implementation of the law is crucial to restore the EU's biodiversity and stop further biodiversity loss, to reach climate neutrality by 2050, adapt to climate change and to enhance food security for EU citizens. It is also a key instrument to help the EU and its Member States meet international biodiversity commitments under the Kunming-Montreal Global Biodiversity Framework. As an overall target to be reached at the EU level, Member States will put in place restoration measures in at least 20% of the EU's land areas and 20% of its sea areas by 2030. By 2050, such measures should be in place for all ecosystems that need restoration.
National Legislation/Policy	
Wildlife & Countryside Act 1981 (as amended by the Wildlife and Natural Environment (Scotland) Act 2012 &	These acts collectively provide protection for wildlife, countryside and natural habitats and address specific conservation needs and priorities in Scotland/*Alba*. The Acts make it an offence to intentionally or recklessly kill, injure,

Title	Relevance to Benthic and Intertidal Ecology
Nature Conservation (Scotland) Act 2004)	take possession of, sell, disturb or harass species listed under Schedule 5 of the Wildlife and Countryside Act 1981.
Conservation (Natural Habitats, &c) Regulations 1994 (as amended) (Habitat Regulations); Conservation of Habitat and Species Regulations 2017 (as amended); Conservation of Habitats and Species (Amendment (Scotland) (EU Exit) Regulations 2019	Together these pieces of legislation transpose the requirements of the EC Directive (92/43/EEC) on the Conservation of Natural Habitats and wild Fauna and Flora (Habitats Directive) into United Kingdom (UK) legislation. The legislation aims to conserve natural habitats and wild flora and fauna by protecting sites that are internationally important for threatened habitats and species (European sites) and provides a legal framework for species requiring strict protection, known as European Protected Species (EPS).
Marine (Scotland) Act 2010	The Marine (Scotland) Act 2010 establishes a comprehensive framework for marine planning and management in Scottish waters. It supports sustainable development while ensuring the protection and enhancement of the marine environment. The Act strengthens conservation measures through the designation and management of Marine Protected Areas (MPAs) and Priority Marine Features (PMFs). Developers are required to assess potential effects on these features and demonstrate how adverse impacts will be avoided, mitigated or compensated.
Marine Strategy Regulations 2010; Marine Environment (Amendment) (EU Exit) Regulations 2018	The Marine Strategy Regulations 2010 translated the requirements of the EU's Marine Strategy Framework Directive into UK legislation and requires the UK to achieve or maintain Good Environmental Status (GES) in the marine environment by 2030. 11 qualitative descriptors are detailed, which describe the environment when GES is achieved. Descriptors relevant to this technical assessment include: • Descriptor 1 – Biological diversity; • Descriptor 2 – Non-indigenous species; • Descriptor 4 – Elements of marine food web; • Descriptor 6 – Sea floor integrity; • Descriptor 7 – Alteration of hydrographical conditions; • Descriptor 8 – Contaminants; • Descriptor 10 – Marine litter. The targets used to assess progress for benthic habitats are:

Title	Relevance to Benthic and Intertidal Ecology
	• The physical loss of each seabed habitat type caused by human activities is minimised, and where possible reversed; • Habitat loss of sensitive, fragile, or important habitats caused by human activities is prevented, and where feasible reversed; • The extent of habitat types adversely affected by physical disturbance caused by human activity should be minimised. The extent of adverse effects caused by human activities on condition, function and ecosystem processes of habitats is minimised. GES for benthic habitats is currently 'Not Achieved'. The achievement of GES is uncertain for intertidal and soft sediment habitats. Sublittoral rock and biogenic habitats have not yet achieved GES.
Wildlife and Natural Environment (Scotland) Act 2011	The Act enabled Scotland/*Alba* to adopt a Code of Practice on Invasive Non-Native Species (INNS), which includes: • Adopting a precautionary approach and not carrying out operations which might lead to the spread of INNS until there is a clear understanding of the situation; • Carrying out risk assessments to understand the risk of spreading an INNS; • Seeking advice and following good practice; • Reporting the presence of INNS.
Sectoral Marine Plan for Offshore Wind Energy 2020	The Sectoral Marine Plan for Offshore Wind Energy, published by the Scottish Government in 2020, provides a strategic framework for the sustainable development of commercial-scale offshore wind energy in Scottish waters, encompassing both inshore and offshore areas. The Plan emphasises the importance of protecting marine ecosystems. Consequently, future developments are required to conduct detailed environmental assessments and implement appropriate mitigation measures to safeguard sensitive marine life.
Scotland's Biodiversity Strategy 2024	Scotland/*Alba*'s Biodiversity Strategy sets out an ambition for Scotland/*Alba* to be Nature Positive by 2030 with regenerated biodiversity across the country by 2045. Improving the

Title	Relevance to Benthic and Intertidal Ecology
	management of sustainable fishing will form a crucial part of protecting and restoring biodiversity in marine waters, to help achieve those goals. As part of this, the Scottish Government has also committed to introduce a Natural Environment Bill to put in place key legislative changes that will restore and protect nature, including, but not restricted to, targets for nature restoration and an effective statutory, target-setting monitoring, enforcing and reporting framework. The Scottish Biodiversity List is a comprehensive inventory of species and habitats identified by Scottish Ministers as being of principal importance for biodiversity and conservation in Scotland/*Alba* and supports Scotland/*Alba*'s Biodiversity Strategy. This list serves as a critical tool for public bodies to fulfil their biodiversity duty and is a valuable resource for anyone involved in nature conservation. It includes a variety of animals, plants and habitats that are prioritised for conservation efforts. The list is aligned with Annex I of the Habitats Directive, which includes habitats of which Special Areas of Conservation (SAC) may be designated.
Marine Policy	
Water Framework Directive (WFD) (2000/60/EC) Water Environment and Water Services (Scotland) (WEWS) Act 2003	Requires EU Member States to achieve GES of water bodies by preventing deterioration and enhancing water quality. Establishes protected areas, monitoring, and mitigation measures for human activities affecting coastal and transitional waters. The WEWS Act transposes the WFD into Scottish law, requiring sustainable water management and River Basin Management Planning.
Scottish National Marine Plan (2015)	The General Policies (GENs) of the Scottish National Marine Plan (NMP) set out key principles for sustainable marine management in Scotland/*Alba*'s waters. Those relevant to this technical assessment are: • GEN 5 requires a reduction in human pressure and the safeguarding of ecosystem services such as natural

Title	Relevance to Benthic and Intertidal Ecology
	coastal protection and natural carbon sinks (e.g. seagrass beds, kelp beds and saltmarsh). In some cases, compensatory habitat creation or enhancement may be possible and should be considered as a last resort if significant harm cannot be avoided. Appropriate proactive opportunities for enhancing natural carbon sinks and allowing natural coastal change where possible should also be considered; • GEN 9 requires developments to comply with legal requirements for protected areas and protected species; not to result in significant impact on the national status of PMFs; and protect and, where appropriate, enhance the health of the marine area; • GEN 10 supports opportunities to reduce the introduction of INNS to a minimum or proactively improve the practice of existing activities. Codes of practice for INNS should be complied with; • GEN 13 states that development should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects; • GEN 21 requires for cumulative impacts affecting the ecosystem to be addressed. FISHERIES 1, FISHERIES 2 and FISHERIES 3 include a requirement to take account for the EU's Common Fisheries Policy, Habitats Directive, Birds Directive and Marine Strategy Framework Directive. Development and activities should take account of the potential impacts on: • Shellfish stocks and resultant fishing opportunities; • Fishing grounds commercially fished grounds; • Displacement of fish stocks, the socio-economic costs to fishers and their communities and other marine users. CABLES 2 requires the following to be considered when reaching decisions regarding cable development: • Consideration of the need to reinstate the seabed, undertake post-lay surveys and monitoring and carry out remedial action where required.

Title	Relevance to Benthic and Intertidal Ecology
Technical Guidance	
OSPAR, Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR Commission, 2008)	The purpose of the OSPAR guidance note is to assist developers in the identification and consideration of some of the issues associated with determining the environmental effects of offshore wind farm (OWF) developments for consideration in the Benthic and Intertidal Ecology impact assessment.
Scottish Natural Heritage (SNH) Identification of Priority Marine Features in Scottish territorial waters (PMF) (Howson *et al*., 2012)	The SNH report describes the process that was developed and used to identify a list of priority marine habitat and species of marine nature conservation importance for which it would be appropriate to use. The guidance sets out a PMF checklist to identify the PMFs which may be impacted, how the PMF may be impacted, the magnitude of change and the significance. This guidance will be incorporated into the Benthic and Intertidal Ecology impact assessment.
Chartered Institute for Ecology and Environmental Management (CIEEM), Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018)	CIEEM methodology for Ecological Impact Assessments have been used to inform the method adopted in this chapter, amongst other criteria.
Natural Resources Wales (NRW) Guidance for undertaking benthic marine habitat survey and monitoring (NRW, 2019)	NRW's report sets out guidance on methods and approaches for survey and monitoring of benthic marine habitats where such work is required to support environmental and ecological impact assessments for developments. The Welsh guidance is referred to in the absence of specific Scottish guidance.
NatureScot advice on Marine non-native species (NatureScot, 2022a)	This advice provides guidance on identification of non-native species and preventing introduction, including Marine Biosecurity Planning guidance. This guidance will be incorporated into the technical assessment and embedded environmental measures.
The Marine Life Information Network (MarLIN), Marine Evidence-based Sensitivity Assessment (MarESA) (Tyler-Walters *et al*., 2023)	The MarLIN 'evidence base' remains the largest review yet undertaken on the effects of human activities and natural events on marine species and habitats. The MarESA is a sensitivity assessment based on a detailed review of available evidence (the 'evidence base') on the effects of pressures on

Title	Relevance to Benthic and Intertidal Ecology
	marine species or habitats, and a subsequent scoring of sensitivity against a standard list of pressures, and their benchmark levels of effect.
Feature Activity Sensitivity Tool (FeAST) (FeAST,2025)	FeAST is a tool - maintained by NatureScot - provides information regarding the sensitivity of marine features in Scotland/*Alba*'s seas, to pressures arising from human activities.

11.3 SCOPING AND CONSULTATION

11.3.1 OVERVIEW

11.3.1.1 This section describes the stakeholder engagement undertaken for the Offshore Project. This consists of early engagement, the outcome of, and response to, the Scoping Opinion in relation to the Benthic and Intertidal Ecology assessment, informal consultation and consultation undertaken though the Preliminary Application Consultation (PAC) process (hereafter referred to as the 'formal consultation'). An overview of engagement undertaken for the Offshore Project as a whole can be found in **Chapter 5: Approach to EIA, Volume 1a** and **Appendix 5.4: Stakeholder Consultation and Engagement, Volume 1c.**

11.3.1.2 Consultation is a key feature of the EIA process and continues throughout the lifecycle of the Offshore Project, from the initial stages through to consent and post consent.

11.3.1.3 Consultation captures all consultation and engagement and has been ongoing with a number of prescribed and non-prescribed consultation bodies and local authorities in relation to Benthic and Intertidal Ecology. All consultation to date has been undertaken in line with the process described in **Chapter 5, Volume 1a** and **Appendix 5.4, Volume 1c**. Feedback received during this process has been incorporated into the EIAR wherever possible as appropriate.

11.3.2 EARLY ENGAGEMENT

11.3.2.1 Early engagement was undertaken pre-scoping with a number of consultation bodies in relation to Benthic and Intertidal Ecology. In accordance with Marine Directorate Licensing Operations Team (MD-LOT) guidance (Marine Scotland, 2024), the Spiorad na Mara Limited (hereafter referred to as 'the Applicant') held formal scoping workshops in May and June 2023 to inform the Scoping Report (Spiorad na Mara Limited, 2023). Further details of the consultation undertaken and the post-workshop feedback can be found in Section 5.3 and Table 5.3-1 of the Scoping Report (Spiorad na Mara Limited, 2023).

Scoping Opinion

11.3.2.2 The Applicant submitted a Scoping Report (Spiorad na Mara Limited, 2023) and request for a Scoping Opinion to the MD-LOT in September 2023. A Scoping Opinion was received in May 2024. The Scoping Report sets out the proposed Benthic and Intertidal Ecology assessment methodologies, outline of the baseline data collected to date, proposed future data collection, and the scope of the assessment. The comments received in the Scoping Opinion and how these have been addressed in this EIAR are provided in **Appendix 5.2, Volume 1c**.

11.3.2.3 A summary of those responses relevant to Benthic and Intertidal Ecology is shown in **Table 11-2**. Regard has also been given to other stakeholder comments that were received in relation to the Scoping Report.

Table 11-2 Scoping Opinion responses – Benthic and Intertidal Ecology

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
NatureScot	Scoping Opinion Response Comments by NatureScot December 2023, Page 4 (Scoping Opinion, Appendix I)	We recommend early consideration of potential Positive Effects for biodiversity as well as nature design aspects at an early stage and following through into the EIAR. We acknowledge that, whilst not policy in the marine environment, these aspects form part of our ability to address both the climate and biodiversity crises and as such we encourage developers to consider that as part of their application.	The Applicant has had due consideration of Nature Inclusive Design from the outset of the project evolution and is actively exploring options for design measures to be incorporated where possible. Further consideration of Nature Inclusive Design will continue throughout the evolution of the project post-consent during the detail design stage.
NatureScot	Scoping Opinion Response Comments by NatureScot December 2023, Page 3 (Scoping Opinion, Appendix I)	In addition to the climate change assessment mentioned in Section 9.8 of the EIA Scoping Report, we recommend that consideration is given to impacts on blue carbon and whether or not an assessment can be undertaken. This should expand on the information and assessment conducted for Benthic and Intertidal Ecology to focus on the potential impacts of the Offshore Project on marine sediments and coastal habitats.	The potential impacts of Offshore Project activities during construction, O&M and decommissioning on blue carbon receptors have been assessed in Sections 11.8.1, 11.8.2, and 11.8.3. This mainly focuses vegetative blue carbon habitats but includes circalittoral mixed sediments. Further assessment of blue carbon is presented in **Chapter 10, Volume 2a.**

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
Marine Directorate	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.4.1, Page 23.	The Scottish Ministers advise the Study Area is expanded to cover the estimated extent of impacts based on the tidal cycle zone of influence.	The original Benthic and Intertidal Ecology Study Area in the Scoping Report (Spiorad na Mara, 2023) included the International Council for the Exploration of the Sea (ICES) Statistical Rectangles A5E2, A5E3 and 46E3, as these rectangles surround the Array Area and provide coverage for the western, northern and northeastern inshore areas surrounding the Isle of Lewis/*Eilean Leòdhais*. The Benthic and Intertidal Ecology Study Area has been refined to cover the worst-case sediment transport impact scenario based on the maximum tidal excursion along the coastline (6 km northeast and southwesterly) (see Section 11.4). This scenario was modelled based on the use of jet trenching to install Array Cables to Final Wind Turbine Generator (WTG) and Array Cables to Landfall (see **Chapter 9, Volume 2a** and **Appendix 9.2: Physical and Coastal Processes Modelling Results Report, Volume 2c** for further details). As a result, the ICES Statistical Rectangles A5E2, A5E3 and 46E3 are still utilised to inform this chapter, however, the Benthic and Intertidal Ecology Study Area does not incorporate the entire rectangle area and only incorporates areas within the worst-case sediment transport boundary (maximum extent to which sediment

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
			mobilised by construction activities would be transported) as no impacts to Benthic and Intertidal Ecology are expected beyond this limit (see Section 11.4).
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.4.2, Page 23.	In respect of data sources, the Scottish Ministers support the list provided in table 6.4-1 of the Scoping Report. However, in relation to baseline characterisation, the Developer is advised that should site-specific surveys identify sensitive species and/or PMF, further surveys may be required to investigate their extent and distribution. The Scottish Ministers advise that this is fully considered in the EIAR.	The list provided in Table 6.4-1 from the Scoping Report has been included in this chapter. Further surveys such as an Environmental Baseline Survey (EBS) including a kelp bed extent survey were also carried out (see Section 11.5 for details regarding site-specific surveys undertaken). Results from these surveys are detailed within Section 11.6. Further survey specifics are detailed within the **Appendix 11.1, Volume 2c**.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.4.3, Page 23.	The Scottish Ministers highlight the NatureScot representation in relation to Environmental Deoxyribonucleic Acid (eDNA) sampling and analysis is not required to inform the EIAR, however it can add significant value to other survey methods.	A site specific eDNA survey was carried out which provides information regarding shellfish and mobile benthic invertebrates within the Benthic and Intertidal Ecology Study Area. Results from the eDNA sampling are detailed within Section 11.6. Further survey specifics are detailed within Annex 2 of **Annex 12.1.2, Volume 2c**.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.4.4, Page 23.	The Scottish Ministers are content with the receptors, and likely significant effects to such, of the Offshore Project as identified in sections 6.4.3.3 and 6.4.5 of the Scoping Report. In relation to the potential impacts to be scoped into and out of the EIAR as summarised in Table 6.5-5 of the Scoping Report, the Scottish Ministers are broadly content however advise that	As advised, these impacts have been scoped in within Section 11.3.3. The introduction and colonisation of INNS is scoped in for the construction phase in Section 11.8.6 and for the O&M phase within Section 11.9.6. Additionally, an INNS Management Plan is provided in

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
		colonisation of hard structures during the O&M phase is scoped in, and removal of hard structures is scoped into the decommissioning phase in relation to changes in substrate and their subsequent removal. Additionally, the Scottish Ministers also advise the introduction and colonisation of INNS is scoped into the O&M phase. This is in line with the NatureScot representation.	**Invasive Non-Native Species Management Plan, Volume 3**.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.4.4, Page 23.	In line with the Scottish Fishermen's Federation (SFF) representation, the Scottish Ministers advise that impacts to benthic invertebrates due to thermal emissions from subsea electrical cables and seasonal stratification of the water column is scoped into the EIAR.	As advised, these impacts have been scoped in within Section 11.4.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.4.5, Page 23.	With regard to the proposed approach to assessment as outlined in Section 6.4.6 of the Scoping Report, the Scottish Ministers are content with this approach. Furthermore, the Developer is advised to consider the use of the FeAST to inform the sensitivity of Benthic and Intertidal Ecology receptors.	The use of the FeAST tool has been incorporated into the methodology (set out in Section 11.9) to inform the assessment of benthic and intertidal habitats and species, as appropriate.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.4.6, Page 24.	In addition to the mitigation measures as set out in Table 6.4-4 of the Scoping Report, the Developer is advised, in line with the NatureScot representation, that consideration is given to ensuring a target cable burial depth of at least 1 m to mitigate the effects of electromagnetic fields (EMFs) on Benthic Ecology receptors.	Array Cables and Export Cables will be buried in soft sediment, where possible, with the use of external cable protection on rocky outcrops, where deemed required. The final choice of burial or surface laid techniques will be subject to a review of the seabed conditions and the Cable Burial Risk Assessment (CBRA) following further ground

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
			investigation during pre-construction. Therefore, surface laying cables with stabilisation is assumed as the maximum design scenario for the assessment. Further details can be found in **Table 11-14** and **Table 11-15**.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.4.7, Page 24.	The Scottish Ministers are unable to provide specific advice due to the lack of detail in the Scoping Report in relation to the cumulative assessment of the impact to Benthic and Intertidal Ecology receptors.	No cumulative impacts with other schemes are anticipated, with rationale on this assessment of cumulative effects provided in Section 11.13.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.4.8, Page 24	In relation to transboundary impacts, the Scottish Ministers are content for the impacts to Benthic and Intertidal Ecology receptors to be scoped out of the EIAR.	Noted.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.5.2, Page 24.	Figure 6-5 -1 of the Scoping Report outlines the proposed study areas for shellfish. The Scottish Ministers advise, in line with the NatureScot representation, extending the boundaries to incorporate the modelled distances for suspended sediment concentration change and underwater noise or vibration.	The Study Area for Benthic and Intertidal Ecology has been amended to cover the worst-case sediment transport impact scenario based on the maximum tidal excursion along the coastline (6 km northeast and southwesterly) (see Section 11.3.3). This scenario was modelled based on the use of jet trenching to install Array Cables to Final WTG and Array Cables to Landfall during the construction phase (see **Chapter 9, Volume 2a** and **Appendix 9.2, Volume 2c**). As a result, this Study Area incorporates areas within the worst-case sediment transport boundary (maximum extent to which sediment mobilised by construction activities would be transported).

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.5.3, Page 24-25.	The Scottish Ministers direct the Developer to the Comhairle nan Eilean Siar (CnES) representation in relation to the guidance on primary data collection from fishing vessels in the area that should be used to inform the baseline for shellfish ecology. The Scottish Ministers advise that, in addition to those listed in Section 6.5.6.2 of the Scoping Report, consideration be given to consultation of further stakeholders provided by Sandwick Community Council and Shawbost Community Council in its representations.	Refer to information provided within the consultation response to CnES. Commercial fisheries data is available within **Chapter 21, Volume 2a**. Relevant shellfish data from this chapter has been included within Section 11.6.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.5.7, Page 25.	INNS are scoped out of assessment for the O&M phase of the Offshore Project. The Scottish Ministers, in line with the CnES representation, advise scoping INNS into further assessment as there is potential for the introduction and spread of INNS even with mitigation, such as the proposed INNS Management Plan, in place.	As advised, these impacts have been scoped in within Sections 11.8 to 11.10. The introduction and colonisation of INNS is scoped in for the construction phase in Section 11.8.6 and for the O&M phase within Section 11.9.7. Additionally, an INNS Management Plan is provided in **Invasive Non-Native Species Management Plan, Volume 3**.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.5.8, Page 25.	The list of potential likely significant effects should be checked against the ScotMER Evidence Map. This view is in line with the NatureScot representation.	The potential impacts identified for benthic species and shellfish as identified in the ScotMER Receptor Group have been included in Section 11.4.4.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.5.10, Page 26.	The Scottish Ministers advise, in line with the NatureScot representation, considering the potential impact pathways from offshore wind in terms of the various phases of the Offshore Project, such as construction,	The potential impact pathways for various phases of the Offshore Project have been detailed within Sections 11.8 to 11.10.

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
		O&M and decommissioning, as well as considering the export cable together with the Array Area.	
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.5.11, Page 26.	The Scottish Ministers agree with the suggested methods of assessment for Fish and Shellfish groups likely to be impacted by the Offshore Project. Regarding PMFs, the Scottish Ministers advise the assessment should quantify where possible, the likely impacts to key PMFs and consider whether this could lead to a significant impact on the national status of the PMFs under consideration. The Scottish Ministers direct the Developer to the guidance provided on this by NatureScot in its representation.	The potential impacts to PMFs have been addressed in Sections 11.8 to 11.10. The Applicant has followed the guidance provided by NatureScot in the Scoping Opinion in relation to PMFs (see **Appendix 5.2, Volume 1c**) during baseline data collection and in determining relevant mitigation to reduce impacts to PMFs, notably micro siting of infrastructure[1]. In addition, potential impacts raised within the scoping opinion have been considered within the assessment.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.5.12, Page 26.	With regard to changes in prey species availability, consideration must be given in the EIA Report to ensure that impacts to key prey species and their habitats are considered in terms of the Offshore Project and cumulatively with other OWF developments. The Scottish Ministers direct the Developer to the NatureScot representation in this regard and advise that this is fully addressed and implemented in the EIAR.	This has been addressed within **Chapter 12, Volume 2a**, **Chapter 13, Volume 2a** and **Chapter 14: Marine and Nearshore Ornithology**, **Volume 2a**.
	Licensing Operations Team Scoping Opinion, May 2024,	The Scottish Ministers are content with the embedded mitigation measures included in Table 6.5-2 of the Scoping Report, however as the area of	The data acquired from the Project and desktop research indicate that the Project is not located within any confirmed spawning areas (Coull *et al.*,

[1] D32 within the commitments register.

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
	Paragraph 5.2.5.14, Page 26.	the Offshore Project lies within spawning and nursery areas, the Scottish Ministers directs the Developer to the SFF representation in relation to the timing of construction activities and advise that this is addressed within the EIAR. Furthermore, the Scottish Ministers advise that consideration is given to mitigation for permanent seabed habitat loss and disturbance in the EIAR. This is a view supported by CnES in its representation.	1998, Ellis *et al.*, 2012. As a precautionary approach, the assessment considers benthic egg laying species' tolerance to disturbance (See section 11.8.3).
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.5.15, Page 26-27.	Ongoing consideration of mitigation measures throughout the lifetime of the Offshore Project is required for both fish and shellfish. Further detail on proposed monitoring of fish and shellfish receptors should be considered within the EIAR. This is in line with the NatureScot and Western Isles District Salmon Fishery Board representations.	Embedded mitigation measures in relation to benthic and shellfish ecology have been included in **Table 11-15** and have been used to inform the assessment in Sections 11.8 to 11.10.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.5.16, Page 27.	In terms of cumulative impacts, the Scoping Report lacks detail in relation to the Applicant's specific approach to the cumulative assessment of impacts on shellfish receptors. The Scottish Ministers therefore cannot provide specific advice in this regard.	Following a review of other developments, no cumulative impacts are expected, as the nearest development to the Offshore Project is over 40 km away.
	Licensing Operations Team Scoping Opinion, May 2024, Paragraph 5.2.5.17, Page 27.	The Scottish Ministers advise that transboundary impacts on most shellfish receptor groups can be scoped out of further assessment.	Noted. This impact has been added to **Table 11-5** within Section 11.4.
NatureScot	Marine Directorate – Science Evidence Data and Digital	For marine fish and shellfish groups, the list of sources should be updated to include:	Desk study sources have been updated to include those stated which contain information

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
	(MD-SEDD) Advice, 27 September 2023	Updating Fisheries Sensitivity Maps in British Waters (Gonzalez-Irusta, 2014) ScotMER: Developing essential fish habitat maps: report. The Study Area for marine fish and shellfish is defined in the EIA Scoping Report section 6.5.2 as 3 ICES Rectangles, one of which encompass the Array Area, and 2 which are outwith but in closest proximity to the Array Area. At this stage, we are uncertain whether this Study Area is adequate, as it is not clear if it encompasses the modelled distances for suspended sediment concentration change and underwater noise/vibration.	regarding shellfish. See Section 11.5 for further details. The Study Area for Benthic and Intertidal Ecology is based on the maximum tidal excursion. This will encompass the worst-case scenario for jet trenching and subsequent suspended sediment concentration (SSC) change. See Section 11.4.2.
		If sensitive species and/or PMFs are found during the surveys, there may need to be follow up surveys to investigate their extent and distribution, and/or consideration of micro-siting requirements.	Results from all surveys are detailed within Section 11.6 (further, detail provided in **Appendix 11.1, Volume 2c**) These include results from the kelp bed survey. Embedded mitigation measures are detailed within Section 11.7.
		Table 6.4-5 describes the impacts to be scoped in or out. We broadly support the proposed approach with the following exceptions: • Colonisation of hard structures – should be scoped into the O&M phase. This could arise through a change in substrate type, leading to changes in ecological communities which should be assessed;	As advised, these impacts have been scoped in within Section 11.4.5.

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
		• Removal of hard structures – should be scoped into Decommissioning phase. Related to the previous point – changes in substrate type and their subsequent removal, should be assessed; • Introduction and colonisation by INNS – should be scoped into the O&M phase. There is potential for INNS to be transported by vessels, and the added infrastructure (WTGs), offshore substation platforms (OSPs), cable protection) can act as settling point and 'stepping stone' for INNS.	
		The proposed embedded mitigation measures in Table 6.4-4 are as expected. We advise that the target burial depth of electrical cables should be at least 1.0 m to mitigate the effects of EMF on benthic ecology receptors.	Cables will be buried in soft sediment, where possible, with the use of external cable protection on rocky outcrops, where deemed required. The final choice of burial or surface laid techniques will be subject to a review of the seabed conditions and the CBRA. Therefore, surface laying cables with stabilisation is assumed for the assessment. Further details can be found in **Table 11-15.**
		The Benthic and Intertidal Ecology Study Area is defined in EIA Scoping Report Section 6.4.2 and comprises the Array Area and Offshore Cable Area of Search (OCAS).	The Benthic and Intertidal Ecology Study Area has been extended to cover the extent of a tidal excursion (6 km), which encompasses the worst-case for suspended sediment mobilisation as a result of jet trenching. See Section 11.4.2.

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
		We would expect to see an additional wider Study Area to cover the estimated extent of impacts, which is usually based on a tidal cycle zone of influence.	
		We support the list of existing datasets provided in Table 6.4-1 that will be used to inform the desk-based review. We advise that eDNA sampling and analysis is not required to inform the EIAR, but we highlight that it can add significant value to other survey methods.	eDNA sampling was carried out which provides information regarding shellfish and mobile benthic invertebrates within the Benthic and Intertidal Ecology Study Area. Results from the eDNA sampling are detailed within Section 11.6. Further survey specifics are detailed within **Annex 12.1.2, Volume 2c**.
		Transboundary impacts are not discussed in this chapter but are briefly mentioned in **Chapter 4: Consideration of Alternatives, Volume 1a**. We advise that transboundary impacts on Benthic and Intertidal Ecology can be scoped out of further assessment.	Noted.
SFF		The impacts to benthic invertebrates due to thermal emissions from subsea electrical cables have not been identified. SFF would like to see the following impacts scoped in since any temperature change in the invertebrate's habitat would have adverse effects on their behaviour and increase their mortality rate: • Impacts to benthic invertebrates due to thermal emissions from subsea electrical cables;	Impacts to benthic invertebrates due to thermal emissions from subsea electrical cables have been scoped in within Section 11.9.8. Impacts to seasonal stratification of the water column have been scoped out. Further details can be found in **Table 11-5**.

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
		• Impact to seasonal stratification of the water column. Besides cable burial, given the lack of scientific proofs that reject adverse effects of EMF and cable heat on fish, shellfish and invertebrates, SFF suggests that precautionary measures to be taken while proceeding with OWFs.	
		Since the development sits in shellfish (Nephrops (Norway lobster), green crab, velvet swimming crab, brown crab, brown shrimp, razor clams and common whelk) spawning and nursery areas, SFF would suggest that construction activities be scheduled outwith the shellfish spawning and nursery periods/seasons to avoid any detrimental effects on the relevant shellfish species.	The data acquired from the Offshore Project and desktop research indicate that the Offshore Project is not located within any confirmed spawning areas.
CnES	Scoping Opinion Response Comments by CnES, 18 December 2023 (Appendix I)	Agreement with the data sources identified to inform the Shellfish Ecology baseline. Further studies required into the shellfish ecology through catch return forms from all fishing vessels in the area. However, further marine surveys in the area will be required to fully identify the shellfish ecology that is present. There is no relevant embedded mitigation for permanent seabed habitat loss and/or disturbance. This would be very damaging to many users and stakeholders in the area and should have further mitigation measures in place to avoid this.	Commercial fisheries data is available within **Chapter 21, Volume 2a**. Relevant shellfish data from this chapter has been included within Section 11.6. Relevant mitigation to reduce impacts to shellfish species is included in **Table 11-15**. This includes the reduction of footprint as much as practicable and micro siting of infrastructure to avoid sensitive areas where practicable.

Consultee	Date/Document	Comment	Response/where this is addressed in the EIAR
		CnES defers to the advice of Marine Scotland Science, Scottish Environment Protection Agency and Nature Scot in relation to Benthic and Intertidal Ecology.	

11.3.3 POST SCOPING CONSULTATION

11.3.3.1 Following the receipt of the Scoping Opinion, no further consultation relating to Benthic and Intertidal Ecology has been held with stakeholders.

11.4 SCOPE OF THE ASSESSMENT

11.4.1 OVERVIEW

11.4.1.1 This section sets out the scope of the EIAR for Benthic and Intertidal Ecology. This scope has been developed as the Offshore Project design has evolved and responds to feedback received to date, as set out in Section 11.3.

11.4.1.2 The shellfish receptor group was originally included in the Fish and Shellfish chapter within the Scoping Report. Shellfish is now incorporated within this chapter 'Benthic and Intertidal Ecology' as the pressures that shellfish experience, impacts they are susceptible to and responses they exhibit are comparable to other benthic invertebrates. As a result, the amendment to include shellfish within this chapter is deemed suitable.

11.4.2 SPATIAL SCOPE AND STUDY AREA

11.4.2.1 The assessment considers the likely significant effects of the Offshore Project on ecological features within its Zone of Influence (ZOI). ZOI is a term used in CIEEM guidance (CIEEM, 2018) and the Study Areas relevant to this chapter have been drawn to match the ZOI(s). Consequently, ZOI has been used in this chapter alongside the term Study Area where appropriate.

11.4.2.2 The Benthic and Intertidal Ecology Study Area (hereafter referred to as the 'Study Area') has been used when describing the baseline (habitats and species), whereas ZOI has been used when discussing the potential extent of impacts of the Offshore Project.

11.4.2.3 The Study Area encompasses the Offshore Project Boundary and suspended sediment worst case scenario ZOI (as described in paragraph 11.4.2.4) to capture the relevant receptors within the identified ZOIs. **Figure 11-1, Volume 2b** shows the Benthic and Intertidal Ecology Study Area.

Suspended sediment Zone of Influence

11.4.2.4 The extent of the suspended sediment ZOI considers the dispersal range of sediments disturbed by activities associated with the Offshore Project, such as jet trenching. The ZOI is defined by the extent of tidal excursion, with due consideration of coastal processes and includes the Offshore Project Boundary, along with an area up to 6 km to the northeast and southwest of the Offshore Project Boundary. See **Chapter 9, Volume 2a** for further detail regarding the methodology used for modelling suspended sediments. The Suspended Sediment ZOI and the Offshore Project Boundary are detailed within **Figure 11-1, Volume 2b**.

Underwater Noise

11.4.2.5 For the assessment of impacts from underwater noise on Benthic and Intertidal Ecology receptors, the ZOI described for suspended sediments has been used (described in paragraph 11.4.2.4). This is due to the lack of literature and guidance on the determination of ZOI for benthic ecology receptors and an understanding that benthic species do not perceive or are impacted by underwater noise in the same way as fish and marine mammals. There is a need for further research regarding the environmental and biological mechanisms of sound propagation relative to invertebrates, and how different invertebrate species respond to noise (Sole *et al.*, 2023). The existing guidance focusses on impacts to fish and marine mammals from underwater noise, which has been studied extensively. The use of the ZOI for fish species, would be disproportionate for the potential effects on benthic receptors and would overestimate the potential ZOI, therefore the ZOI for suspended sediment has been used in this assessment as it was deemed a more proportionate and appropriate approach.

11.4.3 TEMPORAL SCOPE

11.4.3.1 The temporal scope of the assessment of Benthic and Intertidal Ecology is the entire lifetime of the Offshore Project, which therefore covers the construction, O&M, and decommissioning phases. The construction phase is anticipated to commence in 2028/2029 and estimated to last for a period of approximately 5 years (completion in 2032/2033). The O&M phase is expected to last up to 35 years. It is anticipated that the decommissioning phase will consist of the reverse of the construction phase, including a similar duration.

11.4.4 POTENTIAL RECEPTORS

11.4.4.1 The spatial and temporal scope of the assessment enables the identification of receptors which may experience a change because of the Offshore Project. The main receptor groups identified that may experience likely significant effects for Benthic and Intertidal Ecology are outlined in **Table 11-3**:. Important ecological features (IEF)[2] and PMFs[2] contained within these receptor groups

[2] Further detail on IEFs and PMFs is presented in Section 9.6, **Table 11-13**, and **Tables 12-19** and **12-20** of **Chapter 12, Volume 2a**.

and taken forward to the assessment are identified and presented in the baseline conditions (Section 11.6).

11.4.4.2 Intertidal receptors are included within the baseline (Section 11.6.1) to ensure all potentially sensitive features have been considered. However, based on the Project design (see **Chapter 3, Volume 1a**) and the defined impact pathways, only certain impact pathways are considered to have the potential to affect intertidal receptors. Rewritten this to be used the spatial and temporal scope of the assessment enables identification of receptors that may experience change as a result of the Offshore Project. The main receptor groups for Benthic and Intertidal Ecology that may be subject to likely significant effects are outlined in **Table 11-3**. IEFs and PMFs within these receptor groups and taken forward to assessment are presented in the baseline (Section 11.6).

11.4.4.3 CIEEM (2022) introduces the concept of IEFs. These are habitats, species, ecosystems, and their functions/processes that are considered to be important and potentially impacted by the Offshore Project. They are analogous, in general EIA terms, with key receptors though CIEEM places a greater emphasis on the context of nature conservation and ascribes a geographical ranking to them. This assessment has identified IEFs according to the CIEEM guidelines, alongside the use of other sensitivity criteria to capture all aspects of the benthic ecology receptors pertinent to the Project.

11.4.4.4 The potential impacts of the Offshore Project which have been scoped into the assessment (see Section 11.4) have been assessed against the IEFs to determine whether or not the effect is considered significant. The IEFs assessed are those that are considered to be important and potentially affected by the Offshore Project. Importance (or value) may be assigned due to quality of extent of habitats, habitat or species rarity, or the extent to which they are threatened (CIEEM, 2022). Species and habitats are considered IEFs if they have a specific biodiversity importance recognised through the international or national legislation or through local, regional, or national conservation plans (e.g. Annex I habitats under the Habitats Directive, OSPAR, National Biodiversity Plan or the Marine Strategy Framework Directive, Scottish PMFs, and the Scottish Biodiversity list).

11.4.4.5 Additionally, this assessment also considers PMFs, which represent habitats and species of particular conservation importance in Scottish waters. PMFs are nationally recognised for their role in supporting ecosystem function, biodiversity, and the resilience of Scotland's seas, and thus require key consideration during marine planning and licensing applications.

11.4.4.6 Though not a statutory designation, PMFs are an important element within the NMP Policy (2015a), in particular GEN 9 Natural Heritage. This requires the Offshore Project to avoid significant impacts on features of recognised conservation value. In line with NatureScot's PMF guidance (2016), PMFs have been identified using the best available evidence, to inform the appraisal of the potential for significant adverse effects to occur on species and habitats of conservation importance; and the application of appropriate mitigation measures, where appropriate.

Table 11-3: Receptors requiring assessment for Benthic and Intertidal Ecology

Receptor Group	Receptors included within group
Infaunal Benthic Ecology	Species living within the sediments and their related biotopes
Epifaunal Benthic Ecology	Species living on the seabed including species colonising hard substrates and their related biotopes.
Shellfish Ecology	Shellfish species including those of commercial importance.
Blue Carbon	Carbon stored in coastal ecosystems and habitats such as seagrass meadows, kelp beds and saltmarshes. These ecosystems are important for climate change mitigation as they sequester carbon.

11.4.5 ACTIVITIES OR IMPACTS SCOPED INTO ASSESSMENT

11.4.5.1 Potential impacts on Benthic and Intertidal Ecology receptors that have been scoped in for assessment are summarised in **Table 11-4.**

Table 11-4: Activities or impacts scoped into the assessment for Benthic and Intertidal Ecology

Receptor	Activity or Impact	Potential Effect
Construction and Decommissioning		
Infaunal Benthic Ecology Epifaunal Benthic Ecology Shellfish Ecology	**Installation and removal of infrastructure:** During installation/decommissioning of infrastructure, which includes: • Foundation installation (including drilling); • Cable burial via open cut trenching/jet trenching/surface lay/ Horizontal Directional Drilling (HDD) exit pit excavation rock/cutting (dependent upon substrate type); • Decommissioning through removal of infrastructure (including wind turbine foundations and cables as well as all associated scour protection).	**Temporary seabed habitat loss and/or disturbance:** Temporary seabed habitat loss and/or disturbance may temporarily change, disturb or alter habitats, which may subsequently affect associated benthic community composition. Alternatively, a reduction in habitat suitability and available resources may result in displacement of fauna to more suitable or unsuitable areas. **Temporary increase in SSC and turbidity:** Temporary increase in SSC and turbidity may result in adverse effects on benthic communities from increased suspended sediment and resuspended sediment concentrations in water column. This will increase water column turbidity and potentially result in clogging of feeding apparatus/gills with loss of species, and increased exposure to predation. As most of the Study Area comprises bedrock and rocky reef, with discrete areas of coarse sand and gravel, there is less potential for suspended

Receptor	Activity or Impact	Potential Effect
		sediments to extend as far in comparison to finer/silt substrates. **Temporary increase in sediment deposition from mobilised sediment:** Temporary increase in sediment deposition from mobilised sediment may result in adverse effects on benthic communities from the settling of SSCs, resulting in the smothering and repeated dusting of sessile fauna. **Removal of hard structures:** As advised by NatureScot, changes in substrate type and their subsequent removal may lead to changes in ecological communities which should be assessed; for example, the loss of established epibenthic communities. This could also result in potential impacts to commercial fishing through the removal of refuges for shellfish species such as crab and lobster.
	Noise generating construction activities: Disturbance of benthic and shellfish species arising from noise generated from construction activities such as piling, rock cutting and boulder removal, rock drilling and vessel movements and deployment.	**Disturbance from underwater acoustic noise and vibration:** Disturbance from underwater acoustic noise and vibration will potentially result in changes to behaviour, temporary species displacement and avoidance of areas during construction activities.
	HDD Drill Cutting Release Trenchless techniques (such as HDD) may be used to install cables at landfall during the construction phase. HDD employed at the cable landfall location may result in release of drilling fluid mud, drilling arisings or bentonite.	**Release of drilling fluid mud, drilling arisings or bentonite:** HDD can release drilling fluid, muds and very low levels of bentonite into the water column, which may result in temporary impacts to water quality and indirectly impact benthic communities and habitats.
	Vessel activity and installation scour protection.	**Introduction and colonisation of infrastructure by INNS** Increased vessel activity during construction and decommissioning phases[3] will increase the

[3] As decommissioning work is planned decades into the future, the exact methodology for decommissioning and the future ecological baseline surrounding the Offshore Project is unknown. In the Maximum Design Scenario, it is expected that effects relating this impact pathway during the decommissioning phase would be of a similar or lower magnitude than those assessed as part of the construction phase.

Receptor	Activity or Impact	Potential Effect
	During construction there will be increased vessel activity and the introduction of scour protection.	potential risk of introduction of INNS into the area. In addition, the Offshore Project will introduce scour protection along the cable route and beneath the turbine foundations, which has the potential to form additional habitat for INNS to colonise.
	Fishing restrictions during installation or removal of infrastructure: Loss of access to fishing grounds due to construction and decommissioning works[3], which affords protection of benthic habitats from fishing.	**Potential effects on benthic habitats through fishing restrictions:** There may be a loss of access to fishing grounds due to construction and decommissioning works[3]. As such, this area becomes inaccessible to fishing vessels during this phase of the Offshore Project and affords protection of benthic habitats and species from direct and indirect impacts from fishing gear on the seabed.
Blue Carbon	**Installation and removal of infrastructure:** During installation/decommissioning of infrastructure, which includes: • Foundation installation (including drilling); • Cable burial via open cut trenching/jet trenching/surface lay/ Horizontal Directional Drilling (HDD) exit pit excavation rock/cutting (dependent upon substrate type); • Decommissioning through removal of infrastructure (including wind turbine foundations and cables as well as all associated scour protection).	**Temporary increase in SSC and turbidity**; As described for the impact pathways above; relevant to the blue carbon receptors in **Table 11-3**. **Temporary habitat loss and/or disturbance**; As described for the impact pathways above; relevant to the blue carbon receptors in **Table 11-3**. **Temporary increase in sediment deposition from mobilised sediment**. As described for the impact pathways above; relevant to the blue carbon receptors in **Table 11-3**.
O&M		
Infaunal Benthic Ecology Epifaunal Benthic Ecology	**Presence of subsea infrastructure** Placement of subsea infrastructure (WTG foundation and/or scour and cable protection).	**Long-term loss of habitat** The placement of subsea infrastructure will result in the long-term loss of available benthic habitats and may result in changes to community composition (i.e. from infaunal species in soft sediments to epifaunal species or species which colonise artificial substrates) resulting in potential impacts on groups

Receptor	Activity or Impact	Potential Effect
Shellfish Ecology		higher up the trophic scale (i.e. fish communities).
	Maintenance activities Maintenance activities such as, cable repairs and/or remediation, during the lifetime of the Offshore Project.	**Long-term habitat disturbance** Physical disturbance of benthic habitats may arise from maintenance activities during the lifetime of the Offshore Project. While maintenance activities may be relatively infrequent, they will potentially occur throughout the lifetime of the Offshore Project. This disturbance may alter the local habitat for supporting species and displace fauna into more suitable areas.
	Maintenance activities Maintenance activities such as, cable repairs and/or remediation, during the lifetime of the Offshore Project.	**Temporary seabed habitat loss and/or disturbance** Temporary seabed habitat loss and/or disturbance may temporarily change, disturb or alter habitats, which may subsequently affect associated benthic community composition. Alternatively, a reduction in habitat suitability and available resources may result in displacement of fauna to more suitable or unsuitable areas.
	Maintenance activities Maintenance activities such as, cable repairs and/or remediation, during the lifetime of the Offshore Project.	**Temporary increase in SSCs and turbidity** Disturbance of the seabed arising from maintenance activities, may result in adverse effects on benthic communities from SSCs and water column turbidity, resulting in clogging of feeding apparatus/gills, and altering natural behaviours and increased exposure to predation.
	Maintenance activities Maintenance activities such as, cable repairs and/or remediation, during the lifetime of the Offshore Project.	**Temporary increase in sediment deposition from mobilised sediment** Disturbance of the seabed arising from maintenance activities, may result in adverse effects on benthic communities from the subsequent deposition of SSCs resulting in the smothering of sessile fauna.
	Maintenance activities and vessel activity Maintenance activities for WTG, WTG foundation, OSP, OSP foundation, Offshore Cables (Array and Export) as well as increased vessel traffic.	**Introduction and colonisation by INNS** As advised by the Marine Directorate and NatureScot within the Scoping Opinion provided in May 2024, this impact has been scoped in. Colonisation and establishment of INNS on artificial structures could arise through a change in substrate type, leading to

Receptor	Activity or Impact	Potential Effect
		changes in ecological communities which should be assessed. There is also potential for INNS to be transported by vessels, and the added infrastructure (WTGs, OSP, cable protection) can act as a newly available artificial habitat for INNS.can act as a newly available artificial habitat for INNS.
	Presence of subsea cables: Presence of subsea electrical cables, transporting power from the wind farm to Landfall.	**Electromagnetic Field effects:** Subsea cables associated with Offshore Wind Farms (OWFs) can emit EMF into the marine environment. For benthic organisms, EMF may trigger development, physiological, and behavioural responses in sensitive species.
	Presence of subsea cables: Presence of subsea electrical cables, transporting power from the wind farm to Landfall.	**Thermal emission effects:** Elevated sediment temperatures can affect benthic organisms, particularly those with low mobility or those inhabiting coarse, sandy substrates. Some studies suggest that the heat generated from submarine cables can alter sediment properties and influence biological activity at the micro- and macrofaunal levels (Middleton and Barnhart 2022).
Blue Carbon	**Maintenance activities** Maintenance activities such as, cable repairs and/or remediation, during the lifetime of the Offshore Project.	**Temporary increase in SSCs and turbidity**; **temporary increase in sediment deposition**; As described for the impact pathways above; relevant to the blue carbon receptors in **Table 11-3**:
	Presence of subsea infrastructure Placement of subsea infrastructure (WTG foundation and/or scour and cable protection).	**Long-term loss of habitat** (10 years+). As described for the impact pathways above; relevant to the blue carbon receptors in **Table 11-3**:.

11.4.6 ACTIVITIES OR IMPACTS SCOPED OUT OF ASSESSMENT

11.4.6.1 A number of potential impacts have been scoped out of further assessment, resulting from a conclusion of no likely significant effect. These potential impacts have been considered in the knowledge of the baseline environment, the nature of planned works and the wealth of evidence with respect to the type and extent of impacts arising from similar projects, with appropriate consideration of relevant best-practice embedded measures. Each scoped out activity or impact is considered in turn in **Table 11-5**.

Table 11-5: Activities or impacts scoped out of assessment for Benthic and Intertidal Ecology

Activity or Impact	**Rationale for Scoping Out**
Construction and Decommissioning	
Accidental release of pollutants from vessels and plant machinery	The presence of the offshore works vessels and plant machinery operating at the landfall during construction and decommissioning present a risk of accidental release of pollutants from leaks or spills of fuels, and accidental release of construction materials. As such, appropriate measures in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL) and Shipboard Oil Pollution Emergency Plans are included in the Outline Offshore Environmental Management Plan (Outline OEMP) (**Outline Offshore Environmental Management Plan, Volume 3**) to ensure the risk of accidental pollution events are minimised and will not result in a significant effect on benthic and shellfish receptors. Therefore, this potential impact has been scoped out of the EIAR.
Release of contaminants through sediment disturbance into the water column	The release of sediment bound contaminants is scoped out of the assessment as sediment contaminant analysis undertaken within the Offshore Array Area and OCAS identified that polycyclic aromatic hydrocarbons, total hydrocarbon content, polychlorinated biphenyl, Organotins and organochlorine pesticides were below the level of detection at the 7 sample sites successfully sampled for chemical contaminants. The analysis of sediment heavy metal contamination returned levels below the Centre for Environment, Fisheries and Aquaculture Science's action level one for arsenic, cadmium, chromium, copper, lead, mercury and zinc at all sites, with minor exceedances for nickel at 2 sites. In addition, the location of the Offshore Project has no history of heavy industry, with the sediment comprising of mainly of sand and gravel and is therefore unlikely to contain sediment bound contaminants. Further detail on heavy metal contamination relating to the Offshore Project is provided in **Chapter 10, Volume 2a**.
Transboundary impacts	Transboundary impacts have been scoped out of the assessment, as advised by the Scottish Ministers within the Scoping Opinion.
Operation and Maintenance	
Accidental release of pollutant from vessels and WTGs	The presence of works vessels during O&M, and the operational WTGs, introduces risk of pollution from leaks or spills of fuels. However, a marine pollution contingency plan (**Marine Pollution Contingency Plan, Volume 3)**, which complies with requirements and best practices in accordance with the MARPOL and Safety and Oil Environmental Plans (SOE) will reduce the likelihood and reduce the impact of any accidental release of pollutants from O&M vessels and equipment. Therefore, this impact has been scoped out of the EIAR.

Activity or Impact	Rationale for Scoping Out
Release of contaminants through sediment disturbance into the water column	The mobilisation of contaminated sediments from seabed disturbance during maintenance operations, and the subsequent release of contaminants is scoped out of further assessment. This is due to low levels of contamination being recorded in sediment as part of the surveys, and as explained previously for construction and decommissioning. Further detail on sediment disturbance during maintenance operations is provided in **Chapter 10, Volume 2a**.
Transboundary impacts	Transboundary impacts have been scoped out of the assessment, as advised by the Scottish Ministers within the Scoping Opinion.
Ongoing changes to sediment transport system and scouring leading to potential deterioration in sediment and water quality.	Potential localised changes in suspended solids concentrations and sediment siltation rates may result from hydrodynamic changes due to the presence of subsea infrastructure, which may affect water and sediment quality. However, as detailed in **Chapter 9, Volume 2a**, such effects will be **Negligible**, therefore, this impact has been scoped out of the EIAR.
Long-term habitat changes from scouring	As discussed in **Chapter 9, Volume 2a**, the potential impacts from scour have not been assessed as scour protection will be included as part of the project design to prevent localised seabed change around the turbine foundations and cables, and therefore no further assessment is required. As such, this assessment considers the impacts associated with the introduction of scour protection (see Sections 11.8, 11.9, and 11.10).
Impacts to seasonal stratification in the water column	The potential for the Offshore Project to cause stratification of the water column was assessed in **Chapter 9, Volume 2a.** The findings of the literature review in conjunction with the baseline conditions indicate that the impacts on stratification of the water column are likely to be of a **Negligible** magnitude. Baseline data collection was undertaken by Partrac Ltd between 22 July-4 November 2024 at 2 locations within the Offshore Project Boundary. The baseline data recorded very minor thermal stratification between seabed and surface, with a differential of less than 1 degree Celsius across 90% of the monitoring period, indicating a weak stratification of the water column. Based upon the **Negligible** magnitude of change from baseline conditions, impacts from stratification on Benthic and Intertidal Ecology receptors was scoped out of further assessment.
Safety zones resulting in potential effects on benthic habitats through fishing restrictions	Temporary safety zones may be implemented during the O&M phase to support the safe undertaking of maintenance and repair activities within the Offshore Project Boundary. Where implemented, these safety zones would temporarily restrict fishing activity within small, localised areas. Any potential reduction in fishing pressure would be transient, intermittent, and incidental. As such, a discernible beneficial effect cannot be relied upon as part of this assessment.

Activity or Impact	Rationale for Scoping Out
	Safety zones during the O&M phase are anticipated to be implemented infrequently and for short durations over the operational lifetime of up to 35 years. The nature, extent, and duration of O&M safety zones fall well within the maximum design scenario parameters assessed for benthic and intertidal ecology during the construction and decommissioning phases. Construction and decommissioning activities represent the maximum extent, frequency and duration of fishing restrictions associated with safety zones, with multiple concurrent zones potentially in place over defined periods of up to 5 years per phase. By comparison, O&M safety zones are anticipated to be substantially lower in magnitude. As such, any potential effects on benthic and intertidal ecology receptors arising from O&M safety zones are considered to be no greater than those already assessed (likely much less), thus no additional assessment is required.

11.5 METHODOLOGY FOR BASELINE DATA GATHERING AND IMPACT ASSESSMENT

11.5.1 METHODOLOGY FOR BASELINE DATA GATHERING

Overview

11.5.1.1 Baseline data collection has been undertaken to obtain information over the Study Area described in Section 11.4. The current baseline conditions presented in Section 11.6 sets out data currently available information from the Study Area.

Desk study

11.5.1.2 A combination of online data sources, grey literature and other surveys within the vicinity of the Offshore Project have been used to inform the Benthic and Intertidal Ecology assessment and are summarised in **Table 11-6**.

11.5.1.3 The assessment employs European Union Nature Information System (EUNIS) habitat biotopes from both the superseded 2007 (updated in 2012) descriptions and latest 2019 (updated in 2021/2022) descriptions. Where possible, to reflect current best practice, the chapter refers to benthic and intertidal habitat present within the Study Area using the “M codes” associated with EUNIS 2019 biotopes. However, “A codes” - associated with EUNIS 2007 biotopes - have been used where survey data is discussed to ensure alignment with the biotope results those results (**Appendix 11.1, Volume 2c**; Royal Haskoning, 2011).

Table 11-6: Data sources used to inform the Benthic and Intertidal Ecology EIA

Source	Year	Summary	Coverage of Study Area
European Marine Observation and Data Network (EMODnet) – EMODnet broad-scale seabed habitat map for Europe (EUSeaMap)	2021	Modelled distribution of EUNIS biotopes. The system is able to identify keystone species that have been evidenced to inhabit areas with certain environmental conditions and can therefore act as an indicator, allowing inferences of overall community composition.	Full coverage of the Study Area.
EMODnet – OSPAR threatened and/or declining habitats	2020	Known locations of OSPAR threatened and/or declining habitats.	Partial coverage of the Study Area.
EMODnet – Annex I habitats	2019	Known locations of Annex I habitats.	Partial coverage of the Study Area.
Geodatabase of marine features adjacent to Scotland/*Alba* (GeMs) – Scottish PMF	2022	Known locations of PMF.	Partial coverage of the Study Area.
Joint Nature Conservation Committee (JNCC) – Marine Recorder	2000-2019	Database of benthic sample data across the UK's offshore and inshore waters.	Partial coverage of the Study Area.
SNH Biological Analysis of underwater video from proposed MPAs, renewables energy sites and spoil grounds around Scotland (Moore, 2014)	2014	Biological analyses of underwater video from various surveys, including survey west of the Isle of Lewis/*Eilean Leòdhais* in 2013 which partially overlaps the Offshore Project.	Partial coverage of the Study Area.
Royal Haskoning - Lewis Wave Array: Intertidal Survey Report	2011	Intertidal survey commissioned by Lewis Wave.	Partial coverage of the Benthic and Intertidal Ecology Study Area.
Distribution of spawning and nursery ground defined by Coull *et al*., 1998) and Ellis *et al*., 2012)	2012 (inclusive of Coull *et al*., 1998) data)	Widely used dataset identifying the known spawning and nursery grounds of multiple shellfish species in UK and surrounding waters.	Full coverage of the Benthic and Intertidal Ecology Study Area and the rest of the UK's coastal waters.

Source	Year	Summary	Coverage of Study Area
Marine Management Organisation (MMO) UK Fleet Landings Data (including Weight and Value) by species (MMO, 2021)	2016 - 2023	This dataset includes landings data from fisheries operating within UK waters. Although the dataset mainly includes information regarding fish assemblages, shellfish species have also been reported within the landings data. Gear type used includes demersal trawl/seine, dredge, pots and traps, and other passive gears (e.g. hooks).	Data has been extracted for all ICES Statistical Rectangles within the Benthic and Intertidal Ecology Study Area (45E2, 45E3 and 46E3).
Scottish Government (2023) Developing essential fish habitat maps: report.	2023	Maps defining areas of the sea essential to shellfish for spawning, breeding, feeding or growth to maturity. The report and subsequent maps reviewed 29 species including shellfish of relevance to offshore wind development areas.	Full coverage of the Benthic and Intertidal Ecology Study Area and the rest of Scotland/*Alba's* coastal waters.

Site Surveys

11.5.1.4 The surveys that have been undertaken and used to inform this Benthic and Intertidal Ecology assessment are summarised in **Table 11-7.**

Table 11-7: Site surveys undertaken

Survey Type	Scope of Survey	Coverage of Study Area
Spiorad na mara OWF Subtidal Environmental Baseline Survey, 2024. See **Appendix 11.1, Volume 2c** Environmental Characterisation Surveys: October 2023 Kelp Bed Surveys: September 2024	The original sampling plan included 38 co-located drop-down camera (DDC) and grab stations and a further 12 DDC video transects, selected to ground truth changes in substrate type which could indicate a different habitat type. However, an initial *in situ* review of the original scope DDC stations revealed 31 stations to be unsuitable for grab sampling due to the presence of hard substrata and potential Annex I geogenic reef features in some areas. As such, 17 combined DDC/grab sampling stations were added to the scope, resulting in a total scope of 55 combined	Full coverage within the Offshore Project Boundary.

Survey Type	Scope of Survey	Coverage of Study Area
	DDC/grab sampling stations and 12 DDC video transects. 55 DDC stations were sampled (550 still images and 70 videos), and 11 grab samples were collected across the Offshore Project Boundary. During the environmental characterisation survey, the PMF habitat 'Kelp beds' was noted within the OCAS. Subsequently, a comprehensive PMF survey was conducted utilising Unmanned Aerial Vehicle (UAV) and Remotely Operated Vehicle (ROV) to capture more seabed imagery of the area and to better characterise the seabed, with mapping of the extent of kelp beds within the OCAS. 2 UAV flights and ROV sampling along 15 transects resulted in the acquisition of UAV orthosomaic outputs and 730 high-resolution images for subsequent analysis and mapping.	
Spiorad na mara OWF Subtidal Environmental Baseline Survey: Habitat Assessment (see **Appendix 11.1, Volume 2c**: October 2023)	The original sampling plan included 38 co-located DDC and grab stations and a further 12 DDC video transects, selected to ground truth changes in substrate type which could indicate a different habitat type, However, an initial *in situ* review of the original scope DDC stations revealed 31 stations to be unsuitable for grab sampling due to the presence of hard substrata and potential Annex I geogenic reef features in some areas. As such, 17 combined DDC/grab sampling stations were added to the scope. Not all of these stations were sampled successfully. As a result, the overall number of samples included; 55 DDC stations, 11 grab samples for macrobenthic and PSD analysis and 8 samples for full analysis (macrobenthic, PSD and chemical contaminants). The 12 original scoped DDC transects were successfully sampled, and Baited Remote Underwater Video (BRUV) frames were deployed at 7 stations yielding 7 hours of baited video footage.	Full coverage of the Offshore Project Boundary.

Survey Type	Scope of Survey	Coverage of Study Area
	The offshore habitat assessment survey element is detailed within this report.	
eDNA Report (see **Annex 12.1.2, Volume 2c**): 17-27 October 2023	Sediment eDNA samples were collected from successfully sampled chemical contaminant grab stations. This equated to 5 stations which were targeted for eDNA analysis. This included eukaryotes and invertebrates. Water eDNA samples were collected from 10 stations across the site-specific Study Area which encompassed the Offshore Array Area and the OCAS. These 10 locations were positioned at the centroid of 10 of the 12 DDC video transects run as part of the Environmental Characterisation Survey (see **Appendix 11.1, Volume 2c**), as DDC transects were positioned specifically to ground truth changes in substrate type which could indicate a different habitat type. Collecting water eDNA from these locations targeted detection of potentially rare or cryptic species. Water eDNA samples were collected from 3 water depths: surface, middle and bottom. This was specifically undertaken to detect vertebrates.	Partial coverage within the Offshore Project Boundary. Samples positioned specifically to ground truth changes in substrate type which could indicate a different habitat type.

11.5.2 DATA LIMITATIONS AND ASSUMPTIONS

11.5.2.1 For the site-specific surveys, of the 38 original scope DDC/grab stations, 31 failed DCC pre-screening due to the presence of hard substrate and therefore grab sampling was not attempted (see **Appendix 11.1, Volume 2c**). An additional 17 DDC stations were proposed to increase coverage of the Offshore Project Boundary, of which 11 failed DDC pre-screening and grabbing was therefore not attempted. In total, 11 stations were successfully grabbed and of these, it was only possible to collect chemical contaminant samples at 7 stations. The result of this was 55 DDC stations, 11 grab samples for macrobenthic and Particle size distribution (PSD) analysis and 7 samples for full analysis (macrobenthic, PSD and chemical contaminants). Despite this, the data and information collected is considered sufficient to inform a robust baseline for the current assessment.

11.5.2.2 The site-specific surveys encompassed the Offshore Project Boundary and not the entire Benthic and Intertidal Ecology Study Area. However, desktop data was utilised to characterise the areas outside of the Offshore Project Boundary but still within the Study Area. Desk-top study data has the potential to be outdated and lack the detail which is captured by site-specific surveys.

However, the impacts upon benthic and intertidal ecology are anticipated to mainly affect receptors present with the Offshore Project Boundary whereby site-specific surveys have been undertaken. Overall, the characterisation of the whole Study Area from a combination of desk-top study data within the wider Study Area and site-specific surveys within the Offshore Project Boundary is considered suitable to inform the current assessment.

11.5.2.3 No site-specific intertidal survey was undertaken as a trenchless solution for the Export Cables to Landfall or the Array Cables to Landfall is proposed. The HDD avoid disturbance to the intertidal zone, as it is located approximately 500 – 1,500 m offshore, in water depths of 15-27 m mean sea level (MSL).

11.5.2.4 Given the relatively recent development of eDNA as a monitoring tool, there remain gaps in the understanding of several key factors than can influence the interpretation of results. The results of the sediment eDNA invertebrate array analysis were used to assess whether grab sampling overlooked any rare/cryptic macrobenthic species or species of conservation importance. None of the notable taxa recorded in the macrobenthic grab samples were recorded in the sediment eDNA samples. This may be due to some of the limitations associated with eDNA, for example the rates at which different species/groups release DNA into the environment. As a result, the eDNA results are best used to compliment the other samplings methods utilised.

11.5.3 METHODOLOGY FOR ENVIRONMENTAL IMPACT ASSESSMENT

Introduction

11.5.3.1 The project-wide generic approach to assessment is set out in **Chapter 5, Volume 1a.** The following sections provide the assessment methodology used to assess the potential impacts on Benthic and Intertidal Ecology only.

11.5.3.2 The assessment presented in this chapter has been conducted in line with current good practice from CIEEM's Guidelines for Ecological Impact Assessment (CIEEM, 2018). Each receptor has been evaluated within the geographic area relevant to Benthic and Intertidal Ecology and against potential impacts from the construction and operation phases of the Offshore Project.

11.5.3.3 The assessment of potential impacts of the Offshore Project on PMFs have been considered in accordance with the Scottish Marine Plan (NMP) Policy GEN 9 Natural Heritage (2015a). In particular, this approach aims to ensure that the Offshore Project complies with the legal requirements for protected habitats and protected species; avoids significant impacts on the national status of PMFs; and protects the health of the marine area (where applicable). Additionally, this assessment is informed by NatureScot's Priority Marine Features Guidance (2016) for the determination of the potential for significant adverse effects.

11.5.3.4 A matrix approach as described in **Chapter 5, Volume 1a** has been used to determine the significance of effects, by comparing impact magnitude against receptor value and sensitivity. The definitions for magnitude and sensitivity (as detailed in **Table 11-8** and **Table 11-9**) have taken into consideration widely used definitions across environmental assessments in UK waters, professional judgment, and good practice guidelines (CIEEM, 2018).

11.5.3.5 This methodology has been used to assess the construction, O&M and decommissioning phases of the Offshore Project.

Impact assessment criteria

Magnitude

11.5.3.6 The magnitude of impact relates to the level of change compared to the baseline conditions, using the duration, timing, scale, size and frequency to determine the magnitude of the impact to each receptor. Magnitude is evaluated in accordance with the definitions set out in CIEEM's Guidelines for Ecological Impact Assessment, summarised in **Table 11-8.**

11.5.3.7 The following characteristics will be used to assess the magnitude of the impact on Benthic and Intertidal Ecology because of the Offshore Project:

- Type of impact – beneficial or adverse;
- Extent or spatial scope of the impact;
- Reversibility of impact - whether the impact is naturally reversible or reversible through mitigation measures;
- Timing and frequency of the impact, in relation to ecological changes;
- Likely duration of the impact – short term (<5 year), medium-term (5–10 years) or long term (10 or more years).

Table 11-8: Benthic and Intertidal Ecology definitions of impact magnitude classes

Magnitude of Impact	**Definition**
Negligible	Changes to baseline conditions within the range of natural variability.
Low	Partial loss and/or recoverable alteration to the extent, composition or character of a habitat/community, or population of a species, and/or reversal of impacts within 5 years or less.
Medium	Partial loss and/or recoverable alteration in extent, composition or character of a habitat/community, or population of a species, and/or reversal of impacts expected within 5-10 years.
High	Changes to natural conditions that alters the extent, composition or character of a habitat/community, or population of a species beyond the ability of the receptor to recover within a period of 10 years.

Sensitivity (and value)

11.5.3.8 Four-point scales (high, medium, low or negligible) for the sensitivities of habitats and benthic ecology have been developed. These scales have been developed with reference to the MarLIN MarESA (Tyler-Walters, 2023). NatureScot's FeAST has also been used in assessment of sensitivities. FeAST has developed a sensitivity matrix of marine habitats and species to pressures taking place in the marine environment. The FeAST and MarESA sensitivities for each receptor have been detailed within Section 11.8 to Section 11.10. Evidence regarding the assigned sensitivity values is available from the MarESA and FeAST online tools (Tyler-Walters *et al.*, 2023); FeAST, 2023; FeAST, 2025a).

11.5.3.9 The sensitivity of a feature is dependent upon its adaptability (the degree to which a feature can avoid or adapt to an impact), tolerance (the ability of a feature to absorb stress or disturbance without changing character), and recoverability (the temporal scale and extent to which a feature will recover following an impact). In locations where several sensitivity levels are given for features against a potential impact, professional judgement will be used and justified for the assessment[4]. The scales for tolerance and recoverability are included in **Table 11-9** and **Table 11-10**. The matrix scores for sensitivity based on the tolerance and recoverability is presented in **Table 11-11**.

Table 11-9: Assessment scale for tolerance to a defined intensity of pressure for Benthic and Intertidal Ecology

Tolerance	**Description**
High	No fundamental change to the physicochemical character of habitat and no impact on population viability of key/characterising species but may affect feeding, respiration and reproduction rates.
Medium	Some mortality of species (can include high levels of mortality where these are not keystone structural/functional and characterising species) without change to habitats relates to the partial loss of the species or habitat component.
Low	High mortality of key and characterising species with some effects on the physicochemical character of habitat. A major decline/reduction relates to the loss of a large proportion of the extent, density or abundance of the selected species or habitat component, e.g. loss of a large proportion of the substratum.
None	Key functional, structural, characterising species severely decline and/or physicochemical parameters are also affected e.g. removal of habitats, causing a change in habitat types. A severe decline/reduction relates to the loss of a considerable majority of the extent, density or abundance of the selected species or habitat component, e.g. loss of considerable majority of substratum (where this can be sensibly applied).

[4] Additionally, where detailed, industry standard, third-party analysis has informed tolerance, recovery, and/or overall sensitivity, professional judgment has been applied with regard to these sources relevance. Subsequently, the language used to describe sensitivity may also be linked to the justifications of cited source, as opposed to the language used in **Table 11-9** and **Table 11-10**, exclusively.

Table 11-10: Assessment scale for recovery for Benthic and Intertidal Ecology

Recovery	Description
High	Full recovery (return to baseline levels) within 2 years.
Medium	Full recovery (return to baseline levels) within 2–10 years.
Low	Full recovery (return to baseline levels) within 10–25 years.
Very Low	Negligible or prolonged recovery possible, at least 25 years to recover structure and function.

Table 11-11: Sensitivity of a receptor (based upon tolerance and recovery alone) for Benthic and Intertidal Ecology

	Tolerance			
Recovery	**None**	**Low**	**Medium**	**High**
Very low	High	High	Medium	Low
Low	High	High	Medium	Low
Medium	Medium	Medium	Medium	Low
High	Medium	Medium	Low	Negligible

11.5.3.10 The 'value' of a feature also requires consideration in the assessment. Nature conservation status is used for the definition of 'value' as this not only considers the legal protection of species or habitats but embedded within these designations are considerations of ecological and socio-cultural importance.

11.5.3.11 The definitions of value levels have been developed using a four-point scale and example definitions of the value levels are provided in **Table 11-12**.

11.5.3.12 It should be noted that high value and high sensitivity are not necessarily linked within a particular impact. A feature could be of high value (e.g. an Annex I habitat within a National Site Network site) but have a low or negligible physical/ecological sensitivity to an impact – it is important not to inflate significance of effect just because a feature is 'valued'. This is where the narrative behind the assessment is important; the value can be used where relevant as a modifier for the sensitivity assigned to the feature. This mechanism is typically implemented as an application of the precautionary principle, where - as appropriate, and subject to professional judgement - additional considerations may serve a more conservative approach. For example, where there is evidence that features rarity, conservation status, or legal protection may elevate a features importance above its base sensitivity.

Table 11-12: Definitions of value levels for Benthic and Intertidal Ecology

Value	Criteria
Negligible	Common habitats and species: Habitats and species that are not protected under any national, regional or local conservation programmes or designations and have widespread distribution in the Scotland/*Alba*.
Low	Locally important/rare: Habitats or species that form an important prey item for other species of conservation value and that are key components of the fish assemblages within the Study Area.
Medium	Regionally important/rare: Habitats or species protected under national law but not within a national site network site within the Study Area. Species or habitats listed as PMFs or on the Scottish Biodiversity List.
High	Internationally/nationally important/rare: Habitats and species protected under international instruments (e.g., qualifying features of a SAC) and habitats and species that are qualifying features of national site network sites located within Study Area.

Significance

11.5.3.13 Following the identification of the magnitude of the impact (see **Table 11-8**)**,** feature value (see **Table 11-12**) and sensitivity (see **Table 11-11**) it is possible to determine the significance of the effect. The matrix provided in **Table 5-2** in **Chapter 5, Volume 1a** is used as a framework to aid in determination of the impact assessment and provides further detail of what effect is considered to be significant.

11.6 BASELINE CONDITIONS

11.6.1 CURRENT BASELINE

11.6.1.1 Baseline data collection has been undertaken to obtain information over the study areas described in Section 11.4. A summary of the baseline environment has been derived from the results of the desk study data and site-specific surveys detailed in Section 11.5 and is outlined in this section.

General Habitats

11.6.1.2 Based on EUSeaMap 2021 data, the seabed across the Study Area is characterised by a range of substrata, including boulders and cobbles, pebbles and shingle, coarse sands, sands, fine sands, muds and mixed sediments (EMODnet, 2021a).

11.6.1.3 EUNIS 2007 mapping predicted that the majority of the Study Area comprised of A5.14 'Circalittoral coarse sediments' (MC32) followed by A4.1 Atlantic and mediterranean high energy circalittoral rock (MC12). A5.15 'Deep circalittoral sediment' (MD32) is also located outside of the Offshore Project Boundary within the northwestern and northeastern boundaries of the Study Area (EMODnet, 2021a). Habitats are displayed within **Figure 11-3, Volume 2b** and **Figure 11-4, Volume 2b**.

Array Area

11.6.1.4 EUSeaMap mapping for the Offshore Project Boundary predicted that the majority of the Array Area is comprised of A5.14 'Circalittoral coarse sediments' (see **Figure 2** of **Appendix 11.1, Volume 2c**). A4.1 'Atlantic and Mediterranean high energy circalittoral rock' is located within the east and southeastern boundary of the Array Area. Small areas of A5.25 or A5.26 'Circalittoral fine sand' or 'Circalittoral muddy sand' and A5.15 'Deep circalittoral coarse sediment' are also present within the southwest of the Array Area (EMODnet, 2025).

11.6.1.5 In August 2013, Marine Directorate Science (MSS) carried out an underwater video survey to gather biological data on the seabed (Moore, 2014). The survey examined 23 sites in total, with 4 of them overlapping with the west of the Study Area. These sites consisted of:

- A5.14 Circalittoral coarse sediment;
- A5.25 Circalittoral fine sand;
- A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment;
- A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment.

11.6.1.6 The site-specific survey at DDC stations within the Array Area identified a total of 3 EUNIS Level 3 Broad Scale Habitats (BSHs), 4 EUNIS Level 4 habitat complexes, 1 EUNIS Level 5 biotope complex and 1 EUNIS Level 6 biotope in the seabed imagery (see **Figure 12, Appendix 11.1, Volume 2c**). The most commonly encountered biotope was A4.214 'Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock'. This was identified in 123 of the 183 images collected across the Array Area. The second most encountered was A5.14 'Circalittoral coarse sediment' which was identified in a further 30 images. A mosaic between habitats A4.214 and A5.14 was identified in all images collected at station ST005 (**Appendix 11.1, Volume 2c**).

11.6.1.7 Along DDC transects surveyed within the Array Area, 2 EUNIS Level 3 BSHs, 3 EUNIS Level 4 habitat complexes, 2 EUNIS Level 5 biotope complexes and 2 EUNIS Level 6 biotopes were identified. The most commonly occurring was EUNIS A4.214 which accounted for 52 of the 87 images analysed from transects in the Array Area. The remaining images consisted of a variety of A4.2 Circalittoral rock and A5.2 Circalittoral sand and the EUNIS Level 6 biotope A4.2146 '*Caryophyllia smithii*' with faunal and algal crusts on moderately wave-exposed circalittoral rock' which was recorded in 8 images at T005 (**Appendix 11.1, Volume 2c**).

Offshore Cable Area of Search

11.6.1.8 EUSeaMap mapping for the Offshore Project Boundary predicted that the majority of the OCAS is comprised of the EUNIS BSH A4.1 'Atlantic and Mediterranean high energy circalittoral rock'. Small areas of A5.14 'Circalittoral Coarse Sediment' (MC32) are also located within the OCAS. The nearshore region of the OCAS was predicted to comprise of the EUNIS BSH A3.1 'Atlantic and Mediterranean high energy infralittoral rock' (MB12) (EMODnet, 2025).

11.6.1.9 During the site-specific survey at DDC stations surveyed within the OCAS, 2 EUNIS Level 3 BSHs, 2 EUNIS Level 4 habitat complexes and 1 EUNIS Level 5 biotope complex were identified during seabed imagery analysis (see **Figure 12, Appendix 11.1, Volume 2c**). The most common habitat type was A4.214 'Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock' (MC12) which was identified in 114 of the 145 images collected along the OCAS. The second most common habitat type was A5.14 'Circalittoral coarse sediment' (MC32) which was identified within 9 images followed by A4.21 'Echinoderms and crustose communities on circalittoral rock' which was identified in 2 images. A mosaic between A4.21 and A5.14 (MC32) was also observed in 2 images collected from ST019 (**Appendix 11.1, Volume 2c**).

11.6.1.10 Along DDC transects surveyed within the OCAS (see **Figure 6** within **Appendix 11.1, Volume 2c**), 6 EUNIS Level 3 BSHs, 4 EUNIS Level 4 habitat complexes, 4 EUNIS Level 5 biotope complexes and 2 EUNIS Level 6 biotopes were identified. A4.214 was the most commonly occurring habitat and was identified in 71 of the 135 images analysed in this region. The remaining images were identified as wide range of habitats. These included the Atlantic and Mediterranean high (A3.1) and moderate (A2.2A) energy infralittoral rock habitats; A3.116 'Foliose red seaweeds on moderately exposed infralittoral rock' and A3.214 '*Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock' (see **Figures 10** to **13** within **Appendix 11.1, Volume 2c).** A4.2142 '*Alcyonium digitatum*, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock' were also identified, as well as circalittoral coarse (A5.1) and mixed (A5.4) sediments and circalittoral sands (A5.2) (see **Figures 10** to **13** within **Appendix 11.1, Volume 2c).**

11.6.1.11 Seabed imagery captured from the site-specific surveys identified a rocky habitat supporting kelp which was recorded in DDC imagery to the northeast, mostly represented by biotope A3.214 '*Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock' which is a component biotope of the 'Kelp Beds' PMF. ROV imagery collected during the PMF survey indicated the presence of a complex seascape with diverse rock habitats and biotopes typical of the tide-swept environments often associated with the west coast of Scotland/*Alba*. In shallower areas closer to the shore, this supported biotope complexes such as A3.116 'Foliose red seaweeds on moderately exposed lower infralittoral rock' and A3.214 '*Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock'. In deeper areas to the south of the area surveyed during the PMF survey, the biotope complex A4.214 'Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock'. Diverse kelp and mixed red seaweeds dominated these habitats, as shown in **Figure 11-5, Volume 2b**[5].

11.6.1.12 The habitats mapped from the 2024 biotope mapping surveys are detailed within **Figure 11-5, Volume 2b**[5] and include:

- A3.11: Kelp with cushion fauna and/or foliose red seaweeds;

[5] Additional survey data are detailed in **Appendix 11.1, Volume 2c**

- A3.21: Kelp and red seaweeds (moderate energy infralittoral rock);
- A4.21: Echinoderms and crustose communities on circalittoral rock;
- A4.214: Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock;
- A4.2146: *Caryophyllia smithii* with faunal and algal crusts on moderately wave-exposed circalittoral rock;
- A5.14: Circalittoral coarse sediment;
- A5.25: Circalittoral fine sand;
- A5.26: Circalittoral muddy sand.

Intertidal Area

11.6.1.13 There are no EUNIS habitat data from 2019 for the intertidal regions within the Study Area. However, the areas immediately seaward to the intertidal region are composed of A3: Infralittoral rock and other hard substrata (EMODnet, 2025). **Figure 7, Appendix 11.1, Volume 2c** indicates that the intertidal area within the Study Area appears to be of similar rocky substrate. Information is also available from an intertidal Phase 1 mapping survey carried out in 2011 and which was conducted between Siadar and Coig Peighinnean Bhuirgh by Royal Haskoning for the Lewis Wave Array Project (Royal Haskoning, 2011). The intertidal Study Area overlaps with the southeastern region of the current Study Area. Results from the survey align with the UAV imagery, as the predominant substrate type within the intertidal zone comprised a combination of boulders and bedrock. Results indicated that solid bedrock was predominant in more exposed regions and cobbles and sand were present in sheltered bays. The predominant substrate type consisted of a combination of boulders and bedrock. Overall, the survey identified 16 distinct biotopes across the 23 targeted survey points. The intertidal EUNIS habitats identified between Siadar and Coig Peighinnean Bhuirgh include:

- A1.111 *Mytilus edulis* and barnacles on very exposed eulittoral rock (LR.HLR.MuscB.MytB);
- A1.1131 *Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock (LR.HLR.MusB.MytB);
- A1.21 Barnacles and fucoids on moderately exposed shores (LR.MLR.BF) including A1.211 *Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock (LR.MLR.BF.FvesB), A1.213 *Fucus vesiculosis* and barnacle mosaics on moderately exposed mid eulittoral rock (LR.MLR.BF.FvesB), and A1.2141 *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock (LR.MLR.BF.Fser.R);
- A1.411 Corraline crust-dominated shallow eulittoral rockpools (LR.FLR.Rkp.Cor) including A1.4111 Corraline crusts and *Corallina officinalis* in shallow eulittoral rockpools (LR.FLR.Rkp.Cor.Cor);
- A1.421 Green seaweeds (*Enteromorpha spp*. and *Cladophora spp*.) in shallow upper shore rockpools (LR.FLR.Rkp.G);
- A2.11 Shingle (pebble) and gravel shores (LS.LCS.Sh);
- A2.21 Strandline (LS.LSa.St);

- A2.4 Littoral mixed sediment (LS.LMx);
- A3.2111 *Laminaria digitata* on moderately exposed sublittoral fringe bedrock (IR.MIR.KR.Ldig.Ldig);
- A3.2112 *Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders (IR.MIR.KR.Ldig.Bo);
- B3.11 Lichens or small green algae on supralittoral and littoral fringe rock (LR.FLR.Lic) including B3.1132 *Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock (LR.FLR.Lic.Ver.Ver).

Macrofauna and Epifauna

11.6.1.14 The 2013 MSS underwater video survey (Moore, 2014) recorded the following taxa within the Array Area:

- Annelida *Chaetopterus variopedatus*, Serpulidae;
- Bryozoa *Flustra foliacea* and *Parasmittina trispinosa*;
- Cnidaria Urticina sp. and *Urticina felina*;
- Echinodermata Asteroidea (including *Asterias rubens*, *Crossaster papposus*, *Luidia ciliaris*, *Porania (Porania) pulvillus*, *Stichastrella rosea*), *Echinus esculentus*, and *Ophiocomina nigra*;
- Porifera *Polymastia boletiformis*.

11.6.1.15 In the 2011 Intertidal Phase 1 mapping survey, a number of macrofauna were recorded such as anemones, starfish, sea snails, crabs and fucoids (Royal Haskoning, 2011).

11.6.1.16 During the site-specific survey, the most commonly occurring epifauna observed in the DCC seabed imagery across all areas were tubeworms of the family Serpulidae, identified in 318 of the 550 images analysed. The encrusting bryozoan *Parasmittina trispinosa* was the second most common species identified in 232 images followed by cup corals and the soft coral *Alcyonium digitatum*. Echinoderms such as the brittlestars *Ophiothrix fragilis* and *Ophiocomina nigra* were also common across both areas. For a full list of taxa, refer to **Appendix 11.1, Volume 2c.**

11.6.1.17 The most commonly occurring epifauna observed in the seabed imagery acquired during the PMF survey was the edible sea urchin *Echinus esculentus* followed by *Laminaria* sp. (kelp) and the encrusting bryozoan *Membranipora membranacea*.

11.6.1.18 The macrobenthic infauna identified across the Offshore Project Boundary consisted of a total of 957 individuals and 95 taxa recorded. Individuals of the phylum Nematoda (roundworms) were the most abundant taxon sampled accounting for 20.7% of all individuals recorded. This was followed by the triangular Astarte *Goodallia triangularis* and the polychaete *Pisione remota*. The family of polychaetes Polygordiidae, *P.remota* and Nematoda were the most frequently occurring species appearing in all the 11 samples. Multivariate analysis determined that all 11 sample groups belonged to the same cluster group.

11.6.1.19 A total of 6 morphological groups were observed from the BRUV footage across the Offshore Project Boundary. These groups included crustacea (hermit crabs of the family Paguridae) notably pink shrimp *Pandalus montaguii*, Echinoderms (edible sea urchin *Echinus esculentus)* and molluscs (cuttlefish of the family Sepiidae) including common whelk *Buccinum undatum*.

11.6.1.20 None of the notable taxa recorded in the macrobenthic grab samples were recorded in the sediment eDNA samples. Among the taxa that contributed most to total abundance in the macrobenthic grab samples, the polychaetes *Pisione remota* and *Polygordius appendiculatus* were also detected in the sediment eDNA invertebrate array. However, there was low support in the identification for *P.remota* as the sequences matched fewer than 3 identified reference sequences in the database. The most frequently occurring taxon found in all sediment eDNA samples was Paramesochridae, a copepod family. The species with the strongest eDNA signals were the polychaetes *Hesionura elongata* and *Protodrilus oculifer*; and the gastropod *Microhedyle glandulifera*. Of these, only *H.elongata* was recorded in the grab samples.

11.6.1.1 Species present within the Study Area are likely to support other receptors such as fish ecology, marine mammals and commercial fisheries, set out in **Chapter 12, Volume 2a**, **Chapter 13, Volume 2a** and **Chapter 21, Volume 2a** respectively.

Invasive Non-Native Species (INNS)

11.6.1.2 INNS recorded in the West Highlands and Outer Hebrides/*Na h-Eileanan Sia* includes common cordgrass *Spartina anglica*, the Pacific oyster *Magallana gigas,* the Japanese skeleton shrimp *Caprella mutica* and the Japanese wireweed *Sargassum muticum* (Collin *et al.,* 2015; Cook *et al.,* 2014; Kakkonen, *et al*., 2019; Nall *et al.,* 2015; Smith *et al.,* 2014).

11.6.1.3 Across the area within the Offshore Project Boundary, 2 INNS were identified from the site-specific surveys; the polychaete *Goniadella gracilis* which was observed from the grab samples, once at station STAD002 and once at station STAD007 and the red algae *Bonnemaisonia hamifera* which was recorded at Station ST023 from the e-DNA site-specific surveys.

Protected Habitats and Species

Designated Sites

11.6.1.4 The Offshore Project Boundary is located within the vicinity of, but does not overlap, any Designated Sites. Sites within 15 km that are designated for Benthic Ecology and/or Shellfish features are displayed in **Figure 11-2, Volume 2b**. The nearest site designated for receptors in relation to Benthic and Intertidal Ecology is Loch Roag Lagoons SAC, located approximately 6.8 km southwest of the Study Area. Loch Roag Lagoons SAC is a complex of silted lagoons. Tob Valasay, one of the lagoons, contains a diverse range of subtidal habitats. A range of communities are present including beds of eelgrass *Zostera spp* and tasselweed *Ruppia spp*., turfs of marine algae and stands of large brown algae. As the designated sites are located outside of the suspended sediment ZOI (6 km), no impacts are anticipated on any Benthic and Intertidal Ecology features designated as part of the protected areas (JNCC, n.d.). Further consideration has been given to the potential for the Offshore Project to affect the site integrity of any relevant designated sites with benthic features in the **Offshore Report to Inform Appropriate Assessment (RIAA)**.

Annex I Habitats

11.6.1.5 During the site-specific survey, Annex I reef was found to cover an approximate area of 265 km^2, accounting for approximately 95% of the total surveyed area. Of this reef cover, 255 km^2 was mapped with high confidence[6] and 10 km^2 with low confidence. Most of the site-specific survey comprised medium stony reef[7]; with areas of low stony reef and bedrock reef located towards the northeast site survey boundary within the Array Area. Within the OCAS, an area of bedrock reef is situated within the northeastern most corner of the OCAS. Annex I reef features are mapped in **Figure 11-6, Volume 2b**[5]**.**

11.6.1.6 The majority of the Array Area was characterised predominantly by Annex I medium stony reef habitats, with patches of low stony and/or bedrock reef towards the northern boundary, and an extensive region of coarse sediment situated towards the centre of the Array Area. While the stony substrate exhibits overall homogeneity, variations in texture and composition become noticeable. In deeper regions towards the north of the Array Area, patches of low stony substrate coexist with areas of rock and coarse sediment, and mosaic formations of cobbles with coarse sediment. In the western corner of the Array Area, extending towards greater depths, there are patches of medium stony reef, bedrock reef and low stony substrate, forming mosaics of bedrock and medium stony reef interspersed with areas of low stony reef.

11.6.1.7 Seabed imagery obtained via DDC during the site-specific surveys enabled ground-truthing of a large area of bedrock reef within the northernmost corner of the OCAS. The central region and majority of the OCAS was interpreted as medium stony reef. Similar to the Array Area, the deeper southernmost region of the OCAS was predominantly interpreted as medium stony reef. However, within this region, there were interspersed low-elevation areas characterised by a mixture of soft and coarse sediments.

11.6.1.8 In areas where the PMF ‘Kelp Beds’ were found to be present; these were mapped as Geogenic Reef due to obstructions caused by dense algae and kelp making it impossible to delineate boundaries between reef type in this area.

11.6.1.9 Based on the taxa present where Annex I reef was observed in the DDC seabed imagery, an additional assessment was undertaken to understand the functionality of the reef ecosystem and infer its ecological value. Most of the Offshore Project Boundary included reef of good ecological

[6] Confidence levels in habitat mapping refer to the reliability of data used to identify and delineate seabed features. *High confidence* indicates clear, well supported identification through multiple datasets while *low confidence* reflects greater uncertainty, often due to limited or lower resolution data or lack of ground-truth validation.

[7] Annex I reefs are categorised into 3 main types based on their formation and structure: (1) bedrock reefs (geogenic reefs) (2) stony reefs) and (3) biogenic reefs.

value with only a few discrete patches of barren or sparsely colonised reef which resulted in a low and/or poor reef ecological value.

11.6.1.10 It should be noted that Annex I reef is only protected when located within a designated site. The Study Area does not overlap with any nature conservation sites, and as such the Annex I reef is not a designated feature of an SAC. However, reefs are designated under the Scottish Biodiversity List.

11.6.1.11 Maerl beds, aggregations of maerl, hard purple coralline algae are also an Annex I habitat. No Maerl bed habitat was identified within the Study Area, however observations outside of the Offshore Project Boundary (to the southwest of the Study Area) have been reported as EUNIS classification A5.51 'Maerl beds by Tyler-Walters *et al*. (2016).

OSPAR List of Threatened and/or Declining Species and Habitats

11.6.1.12 Kelp forests are included on OSPAR List of Threatened and/or Declining Species and Habitats[8], and are present within the OCAS and Study Area (further detail presented in the following section - PMF) (**Appendix 11.1, Volume 2c**; EMODnet, 2025; **Figure 5, Volume 2b**).

11.6.1.13 Although not present within the Study Area, Maerl beds have been identified outside of the Study Area by Tyler-Walters *et al*., (2016) and are listed as an OSPAR habitat (**Appendix 11.1, Volume 2c**; Tyler-Walters *et al*., 2016, EMODnet, 2025; **Figure 5, Volume 2b**).

11.6.1.14 *Zostera* beds are present in the Loch Roag SAC, approximately 6.8 km south of the Study Area (paragraph 11.6.1.4). Also listed under OSPAR, the habitat type has undergone long-term and wide-scale declines in all four OSPAR regions, primarily due to physical disturbance, marine pollution and increased turbidity and sedimentation rates.

Priority Marine Features (PMF)

11.6.1.15 The shallow (<20 m) eastern area of the OCAS features a large expanse of bedrock and stony reef supporting kelp wherein the dominant EUNIS biotope identified in both site-specific DDC and ROV imagery was A3.214 '*Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock'. This area represents the PMF habitat 'Kelp beds'. High confidence in the boundaries of the kelp bed was attributed to the easternmost section of this PMF habitat where ROV and UAV ground-truthing data was available; where there was a sparsity of data, additional surveys were commissioned to supplement data gaps (see the **Appendix 11.1, Volume 2c**). Kelp Beds PMF areas were mapped covering an area of 9.7 km^2. Interpretation of the acoustic data identified some potential gaps in the extent of kelp, the most prominent of which was located within the OCAS. This habitat is of high ecological importance, supporting elevated levels of biodiversity and is commonly found across the Scottish mainland and islands.

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[8] The OSPAR List of Threatened and/or Declining Species and Habitats identifies important habitats with the aim of helping to protect marine ecosystems within a number of international regions in the North East Atlantic.

11.6.1.16 The PMF habitat 'Tide-swept algal communities' was also found to be present in 5 images (see **Plate 8** and **Figure 2** in **Appendix 11.1, Volume 2c**). In all instances, it was found alongside the PMF 'Kelp Beds' during the PMF survey.

11.6.1.17 The soft sediments encountered across the Offshore Project Boundary represent the PMF habitat 'Offshore Subtidal Sands and Gravels'. This habitat is also a UK BAP habitat. This is one of the most common habitat types found around the British Isles, often home to diverse infaunal communities dominated by polychaetes and small bivalves (Tyler-Walters *et al*., 2016).

11.6.1.18 Although not present within the Study Area, PMFs including Blue Mussel *Mytilus edulis* Beds, Horse Mussel *Modiolus modiolus* Beds, Maerl Beds and Ocean quahog have been identified outside of the Study Area (see **Figure 5, Appendix 11.1, Volume 2c;** EMODnet, 2025; **Figure 11-7, Volume 2b)**.

Commercially Important Species

11.6.1.19 A number of commercial shellfish species are likely present within the Study Area, including Norway lobster *Nephrops norvegicus*, green crab *Carcinus maenas*, velvet swimming crab *Necora puber*, brown crab *Cancer pagurus*, brown shrimp *Crangon crangon*, razor clams *Solen spp*., king scallop *Pecten maximus* and common whelk *Buccinum undatum* (see **Appendix 21.1: Commercial Fisheries Baseline Characterisation Report, Volume 2c**).

11.6.1.20 Previous landings data from 2018-2022 have recorded Norway lobster *Nephrops norvegicus*, mixed species of crabs, squid, scallops and razor clam *Ensis magnus* within the Study Area. (MMO, 2021). Further details can be found within **Chapter 21, Volume 2a.**

11.6.1.21 Nephrops spawning and nursery grounds are not located within the Study Area for Benthic and Intertidal Ecology receptors (Coull *et al*, 1998; NMPi, 2015a; NMPi, 2015b). The nearest recorded spawning and nursery grounds to the Study Area are those located along the East coast of the Isle of Lewis/*Eilean Leòdhais* (Coull *et al.,* 1998; NMPi, 2015a; NMPi, 2015b; Franco *et al*., 2023). Although Norway lobster have been recorded within fisheries landings (see **Chapter 21, Volume 2a**), models predicting their potential for aggregation within the Study Area between 2010-2020 indicated a high confidence in their absence. Habitats scoring high for suitability were not identified within the Study Area and at best, habitats with moderate suitability were identified but with low confidence within the Study Area. These habitats were infralittoral rock, kelp and algal communities, infralittoral and circalittoral coarse sediments and fine muds (Franco *et al.,* 2023).

11.6.1.22 The most suitable habitats for juveniles of brown crab are rocky habitats in the littoral and circalittoral zones. Other possible habitats include kelp and seaweed habitats, maerl beds and seagrass beds. Habitats of moderate suitability with low confidence were predicted within the intertidal areas of the Study Area. Habitats with low suitability and moderate confidence were predicted for the rest of the Study Area.

11.6.1.23 Common cockle *Cerastoderma edule*, razor clam and velvet swimming crab were assessed as unlikely to be present within the Study Area. Dog cockle *Glycymeris glycymeris* had high suitability with moderate to high confidence in the northern boundaries of the Study Area. Common whelk was assessed as having moderate suitability with moderate confidence in the northern boundaries of the Study Area (Franco *et al.,* 2023).

11.6.1.24 Aquaculture active shellfish site for common mussel *Mytilus edulis* was identified approximately 4.7 km south of the Study Area; Loch Carloway (NMPi, 2024).

11.6.1.25 There are 6 economically important species that were identified across the Offshore Project Boundary from the macrobenthic surveys; pink shrimp *Pandalus montagui*, squat lobster Galatheoidea, edible sea urchin *Echinus esculentus*, cuttlefish Sepiidae and common whelk. Across the Offshore Project Boundary, during macrofaunal analysis, 1 juvenile belonging to the economically important family of clams Veneridae was recorded at STAD008 (**Appendix 11.1, Volume 2c**).

Blue Carbon

11.6.1.26 Blue carbon refers to coastal and marine ecosystem's ability to absorb and store carbon dioxide from the atmosphere. Plants, calcifying organisms and sediments all play a role in capturing and storing carbon, both in the short-term (e.g. plants) and long term (e.g. reefs and deep-sea sediments). A major threat to long-term carbon storage is any activity that disrupts the surface layers of sediment such as the installation of subsea cables or the piling of WTG foundations.

11.6.1.27 There are various blue carbon habitats and these fall into 2 categories; seabed sediments and coastal vegetated habitats.

11.6.1.28 The assessment sections provide a qualitative overview of the blue carbon potentially stored within coastal vegetated habitats located within the Study Area. Estimations regarding the amount of blue carbon stored within sediments is detailed within **Chapter 10, Volume 2a**. Coastal vegetated habitats include (Nature Scot, 2023):

- Saltmarsh;
- Kelp forests;
- Intertidal seaweeds;
- Seagrass;
- Maerl.

11.6.1.29 Of the important blue carbon habitats, kelp beds and brittlestar beds *Ophiothrix fragilis* are the only habitats identified as present in the Study Area that supports blue carbon storage or sequestration (see **Figure 11-7, Volume 2b**). During the site-specific surveys, kelp beds were mapped across a 10 km^2 area within the shallow section of the OCAS.

Summary of Baseline Environment

11.6.1.30 The baseline environment has been derived from the results of the desk study data and site-specific surveys detailed in Section 11.6. Based upon this information, **Table 11-13** presents the IEFs[2] relating to Benthic and Intertidal Ecology in relation to their nature conservation protection.

Table 11-13: IEFs within the Offshore Project Benthic and Intertidal Ecology Study Area

Receptor	Designation(s)[9]	Location	Value
General Biotopes			
Protected Habitats			
Annex I Bedrock and/or Stony Reef	• Habitats Directive Annex I under A4.2 Atlantic and Mediterranean Moderate Energy Circalittoral Rock with subtypes: – A3.116 Foliose red seaweeds on exposed lower infralittoral rock *(i)*; – A4.214 Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock; – A4.2141 *Flustra foliacea* on slightly scoured silty circalittoral rock; – A4.2145 Faunal and algal crusts with *Pomatoceros triqueter* and sparse *Alcyonium digitatum* on exposed to moderately wave-exposed circalittoral rock; – A4.212 *Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock; – A4.2144 Brittlestars on faunal and algal encrusted exposed to moderately wave-exposed circalittoral rock;	Array Area OCAS	High

[9] Intertidal receptors are denoted with *(i)*.

Receptor	Designation(s)[9]	Location	Value
	– A4.2146 *Caryophyllia smithii* with faunal and algal crusts on moderately wave-exposed circalittoral rock; – A4.2142 *Alcyonium digitatum*, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock; – A4.215 *Alcyonium digitatum* and faunal crust communities on vertical circalittoral bedrock; – A4.21 Echinoderms and crustose communities on circalittoral rock.		
Kelp Beds	• PMF under A3.214 '*Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock' *(i)*; • Blue carbon habitat; • OSPAR Habitat.	OCAS	High
Tide-swept algal communities	• PMF under A3.213 '*Laminaria hyperborea* on tide-swept, infralittoral mixed substrata' *(i)*; • Habitats of Principal Importance (HPI); • Habitats Directive Annex I.	OCAS	High
Offshore Subtidal Sands and Gravels under the illustrative biotopes: • A5.14 Circalittoral coarse sediment; • A5.25 Circalittoral fine sand;	• PMF; • Scottish Biodiversity List.	Array Area OCAS	Medium

Receptor	Designation(s)[9]	Location	Value
• A5.26 Circalittoral muddy sand.			
A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	• HPI; • Blue carbon habitat.	Study Area	High
Other Habitats			
A5.44 Circalittoral Mixed Sediments	None	OCAS	Low
A5.444 Flustra foliacea *and Hydrallmania falcata* on tide-swept circalittoral mixed sediment	None	Study Area	Low
Commercially Important Species			
Norway lobster *Nephrops norvegicus*	Commercial	Study Area	Medium
Common whelk *Buccinum undatum*			
Pink shrimp *Pandalus montagui*			
Squat lobster Galatheoidea			
Razor clam *Ensis magnus*			
King Scallop *Pecten maximus*			
Brown crab *Cancer pagurus*			
Dog cockle *Glycymeris glycymeris*			

Receptor	Designation(s)[9]	Location	Value
Cuttlefish			
Edible sea urchin *Echinus esculentus*	• Commercial; • International Union for Conservation of Nature (Near Threatened).		

11.6.2 FUTURE BASELINE

11.6.2.1 In the absence of the Offshore Project, the future benthic ecology and environment in the Study Area is likely to experience changes associated with natural variation, climate change and non-climatic factors/impacts. Studies have demonstrated that long-term changes are likely to result from a combination of climatic (e.g. rising sea surface temperatures & levels, ocean acidification) and non-climatic factors (e.g. changes in fishing patterns and contamination), which may affect the responses of benthic species to climate change (see **Chapter 7: Climate resilience, Volume 1a** for further details). The nature of this response will likely be dependent on species' life-history traits.

11.6.2.2 Given the anticipated lifetime of the Offshore Project (35 years), species populations or ranges may alter due to climate change. Studies showed that with rising sea temperatures, species will move into deeper water. Similarly, it is expected that species from the south will move further north, resulting in more biodiversity in the region. It is unlikely that these changes will occur over the course of the Offshore Project construction phase (MCCIP, 2023; Scottish Government, 2021).

11.7 BASIS FOR ENVIRONMENT IMPACT ASSESSMENT

11.7.1 MAXIMUM DESIGN SCENARIO

11.7.1.1 Assessing using a parameter-based design envelope approach means that the assessment considers a maximum design scenario whilst allowing the flexibility to make improvements in the future in ways that cannot be predicted at the time of submission of the consent applications. The assessment of the maximum design scenario for each receptor establishes the maximum potential adverse impact and as a result impacts of greater adverse significance would not arise should any other development scenario (as described in **Chapter 3, Volume 1a**) to that assessed within this chapter be taken forward in the final scheme design.

11.7.1.2 The maximum parameters and assessment assumptions that have been identified to be relevant to Benthic and Intertidal Ecology are outlined in **Table 11-14** and are in line with **Chapter 3, Volume 1a**.

11.7.1.3 Pre-construction surveys will be undertaken prior to installation works to refine the engineering design, confirm seabed conditions, and inform the final micrositing of infrastructure (see Section 3.5.3 in **Chapter 3, Volume 1a**).

11.7.1.4 Although pre-construction surveys may involve some limited and temporary interactions with the marine environment, the potential impacts of any such activities fall well within the MDS parameters assessed for this chapter. The MDS includes activities such as WTG foundation drilling and grouting, and Offshore Cable installation which represent a conservative upper bound on seabed disturbance, and vessel presence. These MDS activities therefore encompass the environmental footprint of pre-construction survey methods, which are significantly lower in magnitude, duration, and spatial extent.

11.7.1.5 For this reason, the potential environmental interactions of pre-construction surveys are not separately assessed, as they are already inherently accommodated within the worst case assumptions underpinning the MDS for this topic.

11.7.1.6 The difference in timing between pre-construction surveys and construction activities does not affect the assessment because the MDS represents the maximum magnitude of change, independent of phasing or scheduling. The pre-construction surveys occur over a much shorter duration and at materially lower intensities than the MDS bounding activities, and therefore do not introduce any temporal additive effects beyond those already assessed.

Table 11-14: Maximum Design Scenario considered for impacts on Benthic and Intertidal Ecology

Offshore Project Phase and Activity/Impact	Maximum Design Scenario	Maximum assessment assumptions	Justification
Construction			
Installation of infrastructure resulting in temporary seabed habitat loss and/or disturbance	The total temporary seabed disturbance from all components of the Offshore Project is: **12,480,875 m^2 (12.481 km^2)**. This includes: **Total seabed disturbance from WTG boulder clearance and foundation installation:** Seabed disturbance associated with the installation of up to 60 WTGs for Scenario 2 (no offshore substation): • Area required for Jack up vessel installation for up to 60 WTGs; • Hybrid Gravity Base (HGB) foundations; • Number of JUV placements per WTG: 2. Seabed footprint: • Seabed disturbance per WTG boulder clearance (area includes for WTG foundation template, JUV placement and clearance): 60,000 m^2; • Total seabed disturbance for WTG boulder clearance: 60,000 m^2 x 60 = **3,600,000 m^2 (3.6 km^2)**. **Offshore Cable boulder clearance disturbance:** Seabed disturbance associated with installation of up to 12 Array Cables and Array Cables to Landfall for Scenario 2 (Onshore Landfall Substation) (including scour stabilisation and protection): • Maximum length of cables: 350 km; • Maximum seabed disturbance corridor width (area includes for cables, cable protection and stabilisation): 25 m; • Installation method: surface lay (across 100% of cable); • Total seabed disturbance for Offshore Cable boulder clearance: 350 km x 25 m = **8,750,000 m^2 (8.75 km^2)**. **Exit Pit Construction:** Seabed disturbance associated with HDD exit pits for Scenario 2 (Onshore Landfall Substation): • Number of exit pits: excavation of up to 13 HDD exit pits (12 plus 1 spare) by rock cutting or grinding; • Exit pit area: 75m x 5m = 375m^2; • Total seabed disturbance for HDD exit pit: 375 m^2 x 13 = **4,875 m^2 (0.004875 km^2)**. **Construction vessel anchorage disturbance:**	N/A	**WTG boulder clearance and foundation installation:** Represents the greatest number of WTGs (including associated ground disturbance) and the longest construction duration, resulting in the greatest extent of temporary seabed habitat loss/disturbance over the longest timeframe. **Offshore Cable boulder clearance disturbance:** Represents the greatest length of cable and assumes installation via surface lay, as this method results in the largest disturbance corridor (25 m) and greatest requirements for cable stabilisation and protection, across the greatest proportion of the cable route (100%), leading to the maximum extent of temporary seabed habitat loss/disturbance over the longest timeframe. **Exit Pit Construction:** Represents the greatest number of HDD exit-pits leading to the maximum extent of temporary seabed habitat loss/disturbance over the longest timeframe. **Construction vessel anchorage disturbance:** Represents the maximum anchor footprint from construction vessels, leading to the maximum extent of temporary seabed habitat loss/disturbance over the longest timeframe[10]. **Repeat Disturbance:** Represents the greatest area for repeated seabed disturbance for WTG installation (i.e. spud leg placement of jack-up vessels will occur following the boulder clearance works, this is expected to be a smaller area than the total seabed disturbance as the vessels won't disturb the prepared area), and Offshore Cable installation (i.e. cable installation will occur following the boulder clearance works, it has been assumed that repeat disturbance could occur across all of the total seabed disturbance area due to the potential number of Offshore Cables installed). **Construction programme:** Represents the maximum offshore construction duration, and parameters for construction within the Offshore Project Boundary.

[10] Anchor area disturbance is considered to be a conservative maximum design scenario. In practice anchoring is unlikely to be conducted regularly particularly during cable installation. Rather vessels will minimise the use of anchors, prioritising the use of dynamic positioning, where possible.

Offshore Project Phase and Activity/Impact	Maximum Design Scenario	Maximum assessment assumptions	Justification
	Anchored vessels may be utilised during the installation of the Offshore Cables within the Offshore Project Boundary. Assumes six-point mooring system with 3m^2 anchors deployed every 500 m of cable. • Maximum seabed footprint per anchor: 3 m^2; • Maximum number of anchor drops: 700; • Maximum seabed footprint: (3 m^2 x 6) x 700 = **126,000 m^2 (0.126 km^2)**. **Repeat disturbance:** Activities to install the WTGs and Offshore Cables will be undertaken within the total seabed disturbance area. However, activities will be undertaken sequentially and so result in repeat disturbance of the seabed. It has been assumed that repeat disturbance could occur for works associated with: • WTG installation: up to 1,440,000 m^2 (1.44 km^2); • Offshore Cable installation: up to 8,750,000 m^2 (8.75 km^2); • Total repeat disturbance: up to **10,190,000 m^2 (10.19 km^2)**. **Construction programme:** • Construction programme: Maximum duration of offshore construction is up to 5 years. Working hours are expected to be 24 hours, 7 days a week. • Offshore construction within the Offshore Project Boundary will only be undertaken during the April-October period, except for offshore Landfall construction works located within the Landfall Exit Pit Area. • Installation of WTG foundations: will be undertaken between April-October over a 2 year period, totalling 14 months of active work.		
Installation of infrastructure resulting in temporary increase in suspended sediment concentration and turbidity; and temporary increase in sediment deposition from mobilised sediment	**WTG Foundation Installation:** Scenario 2 (60 WTGs and 12 Array Cables to Landfall): the installation of up to 60 multi-leg jacket foundations with pin piles via drilling and grouting within the Turbine Area to support up to 60 WTGs. **Number of piles per WTG and spacing:** Each multi-leg jacket pile foundation will have up to 4 legs (1 pin pile per leg), each spaced 30-55 m apart at seabed level and 15-35 m apart at MSL; **Pin pile diameter:** Each pin pile will have a maximum diameter of up to 5 m; **Drilling depths:** Pin piles will be drilled below the seabed to a depth of 15-120 m, depending on location within the Turbine Area (i.e. whether it is inside or outside the buried channel); **Volume of drill arisings:** Per pin pile is 588 m^3, and 141,120 m^3 for all 60 turbine multi-leg jacket foundations (assuming a 30 m average depth per drill event).	**Drilling of Pin Piles to Install WTG Foundations modelling:** modelling results of pin pile drilling activities to install WTG foundations are presented in **Appendix 9.2, Volume 2c** and were used to inform this impact assessment. **Volume of drill arisings:** 4 piles per foundation are modelled in one location; with a volume of 1,374 or 2,356 m^3/pile/day (for foundation depths of 70 m and 120 m, respectively).	**Scenario 2 (60 WTGs and 12 Array Cables to Landfall):** represents the largest spatial extent of infrastructure and greatest volume of potential sediment disturbance during the construction phase. **Number of piles per WTG and spacing:** The resolution of the model mesh is not small enough for a spacing of sediment sources 30-55 m apart to influence the results. Therefore, spacing parameters were not included in the model, this ensures a reasonable computational run time. **Concurrent pile drilling events:** 3 piles are modelled simultaneously, with the single remaining pile for this location modelled on its own, which represents the maximum design scenario. **Maximum pile depth and diameter assumption:** Maximum pile depths and diameter have been modelled to ensure a worst-case volume of sediment disturbance. **Volume of drill arisings:** Maximum design scenario volume of drill arisings per pin pile value is based on a 30 m average embedment depth. Modelling

Offshore Project Phase and Activity/Impact	Maximum Design Scenario	Maximum assessment assumptions	Justification
		Concurrent pile drilling events: The model assumes that 3 pile drilling events will occur concurrently. **Maximum pile depth assumption:** Maximum depth of piles within the buried channel (deeper sections of seabed substrate within the Turbine Area) is 120 m and elsewhere within the Turbine Area it is 70 m. **Tidal modelling assumption:** A neap-spring tidal cycle is modelled with pile installation at the northeastern/southwestern extents of the Turbine Area. **Sediment release:** Sediment plumes associated with foundation installation construction activities are assumed to be limited to 2 m from the seabed (see justification in Section 2.3.3.2, **Appendix 9.2, Volume 2c**).	has used depths of 70 m and 120 m to reflect the maximum depths pin piles will be buried e.g. in the buried channel representing worst case. **Tidal modelling assumption:** A neap-spring tidal cycle has been modelled to allow for an adequate range of tidal levels and current representation in the modelling exercise. Modelled locations at the edge of the Turbine Area shows the maximum extent of sediment disturbance outside the Offshore Project Boundary. **Sediment release:** Sediment disturbed by project construction activities is assumed to be released from within 2 m of the seabed. This assumption enables a conservative assessment of the concentration of the total suspended sediments and subsequent sediment deposition thickness (see Section 2.3.3, **Appendix 9.2, Volume 2c**).
	Array Cable Installation: **Scenario 2 (60 WTG and 12 Array Cables to Landfall):** the installation of 12 66 kV Array Cable to Final WTG (within Array Area) and 12 66 kV Array Cables to Landfall (within OCAS) via jet trenching. **Array Cables:** • Array Cables to Final WTG have a maximum length of 160 km; • Array Cables to Landfall have a maximum length of 190 km; • Maximum length of Array Cables is therefore 350 km and maximum diameter of 300 mm. **Installation method:** • Assumes 60% of cable length (210 km) requires installation via jet trenching;	**Array Cable burial modelling:** modelling results of Array Cable Burial activities are presented in **Appendix 9.2, Volume 2c** and were used to inform this impact assessment**.** **Sediment release:** Assumes Array Cables will be installed at 300 m/hr with 20% of sediment released into the water column.	**Scenario 2 (60 WTGs and 12 Array Cables to Landfall):** equates to the greatest length (350 km) of Array Cables to be installed and greatest area of potential sediment disturbance during the construction phase. **Installation method:** Jet trenching is the worst-case cable installation method as the sediment release is likely to be at a greater height above the seabed (than the other Array Cable burial methods) where current speeds are higher (see paragraph 9.7.1.2 in **Chapter 9, Volume 2a** for further details). **Jet trenching extent:** Jet trenching 60% of the Cable length represents a worst case-scenario as it is the maximum amount of jet trenching that could be undertaken to install the Array Cables.

Offshore Project Phase and Activity/Impact	Maximum Design Scenario	Maximum assessment assumptions	Justification
	Jetting trench has a maximum width of 7 m and depth of 2 m. Seabed disturbance footprint from jet trenching is anticipated to be approximately 1.47 km^2. **Seabed Preparation:** • Assumes 60% of cable length (210 km) requires boulder clearance to facilitate jet trenching; • Boulder clearance width of 15 m; • Seabed disturbance footprint from boulder clearance is anticipated to be approximately 3.15 km^2.		**Sediment release:** Speed and percent of sediment released are reasonable worst-case values based on similar assessments. See Table 2-3 in **Appendix 9.2, Volume 2c** for details on sediment mass flux in different locations within the Study Area. **Seabed preparation:** The potential impacts of seabed preparation activities, including boulder clearance using a boulder plough or boulder grab, were considered as part of the identification of the maximum design scenario for the Physical and Coastal Processes assessment. These activities were reviewed alongside the full range of potential cable installation methods. As outlined in Section 9.7.1.2, **Chapter 9, Volume 2a**, a comparison of ploughing, jetting and mechanical cutting indicated that jet trenching would result in the greatest sediment disturbance and seabed change, due to the volume of sediment mobilised. On this basis, jet trenching was selected as the basis for the modelling assessment as it represents a conservative worst-case scenario for sediment mobilisation associated with either cable installation or seabed preparation activities. The potential impacts of seabed preparation are therefore inherently encompassed within the modelling of jet trenching, which captures the upper bound of sediment disturbance and seabed change that could reasonably arise from these activities. Separate modelling of seabed preparation is not required, as it would not result in impacts greater than those already assessed under the maximum design scenario.
	HDD Exit Pit construction: Excavation of up to 13 HDD exit pits by rock cutting or grinding. **Sediment volume:** • Maximum volume of sediment excavated per HDD Exit Pit: 75 m length x 5 m width x 3.5 m depth = 1,312.5 m^3; • Maximum volume of sediment excavated from all 13 exit pits is 17,062.5 m^3.	**HDD activities modelling:** modelling results of HDD activities are presented in **Appendix 9.2, Volume 2c** and were used to inform this impact assessment. **Sediment types:** Assessment considers range of sediment sizes which could be released by rock cutting or grinding.	**Number of Exit Pits:** 13 exit pits equate to 1 per each of the 12 Array Cables and an additional contingency exit pit to account for exit pit collapse, reflecting the maximum number of exit pits the Offshore Project may construct. **Sediment types:** The methods (cutting or grinding) for constructing the HDD exit pit construction may release fine or coarse sediment into the water column. There is also uncertainty around sediment properties in the Exit Pit Area and therefore it is appropriate to assess a range of sediment sizes. Coarse and fine sediments behave in different ways and so represent a worst-case for different situations (for example finer sediments can be advected over a greater distance by currents, however coarser sediments will settle in smaller areas with larger deposition thicknesses). **Sediment volume:** Represents greatest volume of sediment that could be released into the water column during the excavation of a single exit pit. The

Offshore Project Phase and Activity/Impact	Maximum Design Scenario	Maximum assessment assumptions	Justification
			HDD drill cutting release models a similar volume of sediment release for fine sediment in the same location and likewise with Array Cable trenching for coarse sediment.
Noise generating construction activities: Resulting in disturbance from underwater acoustic noise and vibration	**Underwater noise (impulsive noise):** Maximum number of foundations: The installation of up to 60 multi-leg jacket foundations with pin piles to support up to 60 WTGs and 1 multi-leg jacket foundation to support 1 OSP within the Turbine Area. • Percussive piling exclusion area: percussive piling will not be undertaken in the southwest portion of the Turbine Area. **Percussive Piling:** Percussive Piling Area: percussive piling will only be undertaken within the northeast portion of the Turbine Area. A maximum of 35 WTG foundations and 1 OSP foundation will be installed via percussive piling in the northeast portion of the Turbine Area. • **Maximum number of WTG foundations requiring piling:** a maximum of 35 multi-leg jacket foundations, with up to 4 pin piles each equates to a total of 140 pin piles to be installed via percussive piling. • **Maximum number of OSP foundations requiring piling:** 1 OSP foundation with up to 16 pin piles equates to 16 to a total of 16 pin piles to be installed via percussive piling. • **Maximum pin piles to be installed via percussive piling:** 156. **Duration:** limited the length of percussive piling installation of pin piles to 5.5 hours and casings to 4.5 hours per 24-hour period. This is inclusive of soft start and ramp up procedures. **Concurrent piling:** No concurrent percussive piling events are permitted. **Maximum hammer energy:** Variable maximum hammer energy across the Percussive Piling Area. This area is split into 3 zones to limit the maximum hammer energy, zones have increase maximum hammer energy of 2,500 kJ, 3,500 kJ, and 5,000 kJ increasing towards the north of the site. **Construction programme:** Installation of WTG foundations (drilling or piling): will be undertaken between April-October over a 2-year period, totalling 14 months of active work (see **Appendix 3.1, Volume 1c**).	**Underwater noise modelling:** percussive piling of foundation pin piles was modelled and the results are presented in **Appendix 13.3, Volume 2c** and were used to inform this impact assessment. The parameters are presented in Section 3.4 of **Appendix 3.1: Percussive Piling Installation Approach, Volume 1c**).	Represents the maximum number of piles, the maximum possible duration of piling and the greatest hammer energy (leading to the greatest propagation of noise into the water column) as defined in **Appendix 13.3, Volume 2c** over the longest timeframe.
HDD Drill Cutting Release, release of drilling fluid mud,	**Number of bores and volume:** Up to 13 bores drilled with a maximum volume of 1,285 m^3 per bore.	**HDD activities modelling:** modelling results of HDD activities are presented in	**Number of bores and volume:** Represents maximum number of bores and volume per bore reflecting worst case scenario.

Offshore Project Phase and Activity/Impact	Maximum Design Scenario	Maximum assessment assumptions	Justification
drilling arisings or bentonite.	**Number of rigs:** 2 drill rigs. **Drill release duration:** 24 hours working, 7 days a week. **Drill fluid density:** Volume of suspended cuttings varies dependent on drilling fluid density.	**Appendix 9.2, Volume 2c** and were used to inform this impact assessment. **Single bore modelled:** Single representative bore release modelled at a central point within the Landfall Exit Pit Area. **Tidal modelling assumption and drill release duration:** Drill releases of entire bore over 1 hour at a peak spring tide and during slack water on a neap tide. **Drill fluid density:** Assumed 27% cuttings in a very dirty drilling fluid.	**Number of rigs and single bore modelled:** Whilst the Project Design Envelope allows for concurrent HDD activities, works will be managed so that break out activities will occur sequentially (i.e. 1 break out activity is undertaken at once). Although there will be up to 13 HDD bores, only 1 activity has been modelled in a central location to provide a representative drill release scenario. **Tidal modelling assumption:** The modelled release point at mid-tide on a peak spring has the potential to transport the sediment plume furthest. This is a worst-case impact in terms of extent. The HDD release at slack water on a neap tide is also modelled which will likely result in a higher SSCs. However, this will likely be over a smaller area. **Drill release duration:** Release over 1 hour is a reasonable worst-case for SSCs. **Drill fluid density:** 27% represents worst case drill cutting percent.
Vessel activity and installation scour protection, resulting in introduction and colonisation of infrastructure by invasive non-native species.	**Construction vessel presence:** • Maximum number of vessels within the Offshore Project Boundary (208.2 km^2) at any one time is 35; • Maximum installation vessel movements (return trips) per year is up to 871; • Maximum duration of offshore construction is up to 5 years. Working hours are expected to be 24 hours, 7 days a week; • Refer to Table 3-19 in **Chapter 3, Volume 1a**, for more details on vessel types and movements. **Installation of scour protection around WTG foundations and cable protection around surface laid Offshore Cables:** Scenario 2: without OSP: Maximum long-term habitat loss = **2,411,500 m^2 (2.411 km^2)**: **WTG Foundations:** • Up to 60 WTGs; • HGB foundations; • Seabed footprint per foundation (including foundation area and scour protection) = 105 m x 105 m • Maximum footprint: (105 m x 105 m) x 60 = **661,500 m^2 (0.662 km^2)**. **Offshore Cables:** • Cable length: 12 Array Cables to Final WTG (within the Array Area) and 12 Array Cables to Landfall (within the OCAS) equating to a maximum cable length of 350 km; • Maximum corridor width (including cable stabilisation and protection) = 5 m;	N/A	**Construction vessel presence:** Represents maximum amount of construction vessel traffic anticipated in the Offshore Project Boundary throughout the construction phase. Construction vessels have the potential to introduce INNS species to the Offshore Project Boundary, for example through the release of bilge and ballast water from vessel hulls. **Installation of scour protection around WTG foundations and cable protection around surface laid Offshore Cables:** represents greatest amount of material that will be introduced to the marine environment which could facilitate the introduction and colonisation of INNS within the Offshore Project Boundary.

Offshore Project Phase and Activity/Impact	Maximum Design Scenario	Maximum assessment assumptions	Justification
	• Maximum footprint: 350 km x 5 m = **1,750,000 m² (1.75 km²)**.		
Fishing restrictions during installation of infrastructure, resulting in potential effects on benthic habitats through fishing restrictions.	**Scenario 2 (60 WTG and 12 Array Cables to Landfall):** the installation of 60 WTGs and 12 Array Cable to Final WTG (within Array Area) and 12 Array Cables to Landfall (within OCAS) via surface lay. **Safety zones:** • 500 m safety zones for the installation/construction of all offshore infrastructure during the construction phase. This includes the installation of WTG and OSP (and their foundations); • 50 m safety zones around partially complete structures or complete structures ahead of commissioning; • 500 m radius advisory safe passing distance around Offshore Project vessels undertaking cable installation; • If multiple construction activities are taking place at the same time separate safety zones will be sought for each activity. **Duration of safety zones:** Safety zones and/or advisory safe passing distances in place throughout construction phase. Maximum duration of offshore construction is up to 5 years, with work programmed within the Turbine Area between April and October, totalling 35 months of active work. Working hours are expected to be 24 hours, 7 days a week.	N/A	**Scenario 2 (60 WTG and 12 Array Cables to Landfall):** represents the largest spatial extent of offshore infrastructure that will require temporary safety zones during the construction phase. **Safety zones:** represent the maximum area that will be temporarily subject to a safety exclusion zone per offshore infrastructure and vessel. **Duration of safety zones:** safety zones will be established around project vessels and active construction works throughout the construction phase representing the greatest length of time that fishing restrictions will be in place.
Operation and Maintenance			
Presence of subsea infrastructure resulting in long-term loss of habitat	**Presence of up to 60 WTGs and Array Cables:** (Scenario 2 without OSP) across the project lifetime up to 35 years. Maximum long-term habitat loss = **2,411,500 m² (2.411 km²)** **WTG:** • Up to 60 WTGs; • HGB foundations; • Seabed footprint per WTG (including foundation area and scour protection) = 105 m x 105 m; • Maximum long term seabed habitat loss of WTGs: (105 m x 105 m) x 60 = **661,500 m² (0.662 km²)**. **Offshore Cables:** • Cable length: 12 Array Cables to Final WTG (within the Array Area) and 12 Array Cables to Landfall (within the OCAS) equating to a maximum cable length of 350 km; • Maximum corridor width (including cable stabilisation and protection) = 5 m; • Maximum long term seabed habitat loss for Array Cables: 350 km x 5 m = **1,750,000 m² (1.75 km²)**.	N/A	Represents the maximum number of WTGs assuming the foundation type with the greatest seabed footprint, along with associated scour protection, the maximum length of Array Cables and cable protection, and greatest number of HDD Exit Pits thus the greatest extent of long-term habitat loss.

Offshore Project Phase and Activity/Impact	Maximum Design Scenario	Maximum assessment assumptions	Justification
	Presence of HDD Exit Pits: • Maximum of 13 HDD Exit Pits; • Maximum area: maximum area of 75 m length x 5 m = 375 m^2 per exit pit, and total of **4,875 m^2 (0.0049 km^2)** for 13 exit pits. Under the maximum design scenario for impact duration for this impact-pathway, the WTG scour protection, WTG foundations located below seabed level, and the Offshore Cables (including associated scour protection) are assumed to remain in-situ permanently. All other project components located above the seabed are assumed to remain in place throughout the operational period and until decommissioning, with their duration of presence extending until such decommissioning activities commence.		
Maintenance activities, resulting in long-term habitat disturbance and temporary seabed habitat loss and/or disturbance.	**Total short-term seabed disturbance from all components of the Offshore Project: 27,610,800m2 (27.610 km^2):** Maintenance activities includes major/minor component replacement and repairs, scheduled inspections and unscheduled maintenance of offshore infrastructure, with repairs and replacement required on an ad hoc basis. It is estimated that the maintenance activities will require: **WTG short term disturbance:** • Major component replacements: up to x 3 per WTG over lifetime (180 total); • Minor component replacements: up to x 10 per WTG per year (21,000 total); • Seabed disturbance per replacement using Jack Up Vessel: • Area of spun cans (280 m^2) x number of positions (2) = 560 m^2; • Total short term seabed disturbance of WTGs: 21,180 x 560 m^2 = **11,860,800 m^2 (11.86 km^2)**. **Array Cables short term disturbance:** • Repair and replacement of Array Cables required: up to 9 times during lifetime; • Seabed disturbance for Array Cables (as per construction): 1,750,000 m^2 (1.75 km^2); • Total short term seabed disturbance of Array Cables: 9 x 1,750,000 m^2 = **15,750,000 m^2 (15.750 km^2)**.	N/A	Maintenance activities are expected to occur with a lower intensity than those during construction. It is assumed that Array Cables will require reburial/protection up to 6 times across the Offshore Project lifetime, and will be repaired or replaced up to 9 times across the Offshore Project lifetime. As such, construction activities are assumed to represent a maximum design scenario.
Maintenance activities, resulting in temporary increase in suspended sediment concentration and turbidity; and temporary increase in sediment deposition from mobilised sediment.	The maximum design scenario used for this assessment are identical to those detailed for the Offshore Project Phase and Activity/Impact '*Maintenance activities, resulting in long-term habitat disturbance and temporary seabed habitat loss and/or disturbance*'.	N/A	The justification is the same as that provided for the Offshore Project Phase and Activity/Impact '*Maintenance activities, resulting in long-term habitat disturbance and temporary seabed habitat loss and/or disturbance*'. No modelling has been done for SSC during the O&M phase, but levels are expected to be equal to or lower than during construction (see **Chapter 9, Volume 2a**). This is because the 'multiple activities' modelling scenario, during the construction phase, simulated a maximum suspended sediment concentration during drilling of 4 WTG foundations (each with 4 piles), and burial of cables (assuming drilling and cable burial activities happen sequentially) per month. It is not expected that such large-scale works will be

Offshore Project Phase and Activity/Impact	Maximum Design Scenario	Maximum assessment assumptions	Justification
			undertaken during the O&M phase. Therefore, temporary increase in suspended sediment concentrations and sediment deposition during operation and maintenance will be of lower magnitude and frequency than that of construction.
Maintenance activities and vessel activity, resulting in the introduction and colonisation by invasive non-native species	The maximum design scenario used for maintenance activities portion of this assessment are identical to those detailed for the Offshore Project Phase and Activity/Impact '*Maintenance activities, resulting in long-term habitat disturbance and temporary seabed habitat loss and/or disturbance*'. **O&M vessel presence:** • Maximum number of vessels in the Offshore Project Boundary (208.2 km^2) at any one time is 10; • Total maximum O&M vessels movements (return trips) is up to 32,034 over the 35 year operational lifetime.	N/A	**Maintenance activities:** It is assumed that Array Cables will require reburial/protection up to 6 times across the Offshore Project lifetime, and will be repaired or replaced up to 9 times across the Offshore Project lifetime. Maintenance activities that introduce new material to the Offshore Project Boundary (e.g. the addition of rock protection for cable protection repairs) could facilitate the introduction and colonisation of INNS within the Offshore Project Boundary. **O&M vessel presence:** Represents the maximum amount of O&M vessel traffic anticipated in the Offshore Project Boundary throughout the O&M phase. O&M vessels have the potential to introduce INNS species to the Offshore Project Boundary through the release of bilge and ballast water from the vessel hulls.
Presence of subsea cables, resulting in electromagnetic field effects	EMF analysis has determined that the 2 scenarios outlined below equate to the maximum design scenario: **Scenario 1 - Offshore Substation:** • Array Cables (66 kV, 900 A, 300 mm) running from WTGs to an OSP (Array Cables located within the Array Area); • 2 Export Cables (220 kV, 1,400 A, 400 mm) extending from the OSP to Landfall (Export Cables located in Array Area and OCAS). **Scenario 2 - No Offshore Substation:** • Array Cables (66 kV, 900 A, 300 mm) running from WTGs to the final WTG in the string (Array Cables located within the Array Area); • 6 Array Cables to Landfall (132 kV, 900 A, 300 mm) running from the final WTG in the string to Landfall (Array Cables to Landfall located in Array Area and OCAS).	**Each scenario was modelled under the following installation and environmental conditions:** **Array Cables:** Array Cables are comparable between Scenarios 1 and 2 as it is assumed that these cables will be directed to a central location within the Array Area before being connected to shore. **Cable installation scenarios:** • Buried cables at a depth of 0.5 m; • Surface-laid cables (i.e. no burial). **Tidal current scenarios:** • Maximum tidal current: 0.9 knots (kn); • Minimum tidal current: 0.1 kn;	Two scenarios representing the greatest voltages being considered, have been modelled to ensure we have understood and assessed the Array Cable scenario that generates the EMF with the greatest strength. The 2 maximum design scenarios represent the greatest amount of current and voltage flowing through the Offshore Cables during the O&M phase and therefore will produce the greatest strength electric fields (E-fields) and magnetic fields (B-fields) and therefore greatest potential to disrupt electrosensitive and magneto sensitive benthic and intertidal receptors.

Offshore Project Phase and Activity/Impact	Maximum Design Scenario	Maximum assessment assumptions	Justification
		• Average tidal current: 0.4 kn. See Section 12.9.5.4 to 12.9.5.6 of **Chapter 12, Volume 2a** for further details on EMF modelling assumptions.	
Presence of subsea cables, resulting in thermal emission effects	**6 Array Cables to Landfall (900 A, 300 mm) with a maximum voltage of 132 kV:** • Maximum length: 250 km, • Spacing between each Array Cable: 10 m; • Cable burial depth: 0.2-2 m below seabed in coarse sand (surface laid and protected by rock placement in some locations, see paragraph 11.9.8.4 for further detail). **O&M duration:** up to 35 years.	N/A	**6 Array Cables to Landfall with a voltage of 132 kV:** Array Cables to Landfall transmitting at maximum voltage are assumed to have the potential to generate elevated heat levels over the greatest area, which could affect nearby sediment temperature. **Cable burial depth:** buried cables will generate greater amount of thermal emissions as they are not exposed to the cooling effects of water. **O&M duration:** greatest timeframe that Array Cables will be operational and generating heat.
Decommissioning			
Removal of infrastructure	The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment. Activities equivalent to or less than the Construction phase. This is because, unlike construction, seabed clearance is not expected to be required for foundation installation or along cable routes. Any seabed clearance during decommissioning is likely to be limited to the placement of jack-up vessel legs. The assumptions for the construction phase therefore apply. Following the operation and maintenance phase, components of the Offshore Project may be left in-situ to avoid unnecessarily disturbing the seabed (i.e. where marine habitat has formed). This could include scour protection associated with the WTG foundations and sections of the Array Cable. The potential for infrastructure to remain in-situ will be confirmed through consultation on the Decommissioning Programme to ensure the most suitable approach is taken. At this stage it is unconfirmed which components (if any) would remain in-situ, however, under the maximum design scenario it has been assumed that all infrastructure above the seabed would be removed. **Decommissioning programme:** Duration is up to 5 years.	N/A	Decommissioning activities are expected to occur with a lower intensity than those during construction, as such, construction activities represent a maximum design scenario.

11.7.2 EMBEDDED MITIGATION MEASURES

11.7.2.1 As part of the Offshore Project design process, a number of embedded mitigation measures have been adopted to reduce the potential for impacts on Benthic and Intertidal Ecology, and these have evolved over the development process as the EIAR has progressed and in response to consultation.

11.7.2.2 The embedded mitigation measures also include those that have been identified as good or standard practice and include actions that would be undertaken to meet existing legislation requirements. As there is a commitment to implementing the embedded mitigation, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of the Offshore Project and are set out in this EIAR.

11.7.2.3 **Table 11-15** sets out the relevant embedded mitigation measures within the design and how these affect the Benthic and Intertidal Ecology assessment.

11.7.2.4 For the purposes of this EIA, effects are assessed on a conservative worst-case basis and no reliance is placed on the avoidance elements of the embedded measures at this stage (M001, M002). This approach reflects the fact that the extent to which sensitive areas can be avoided, or optimal burial achieved, cannot be quantified until detailed design and further site-specific investigations are complete; the assessment therefore does not assume full avoidance and remains robust under conditions of uncertainty.

Table 11-15: Relevant Benthic and Intertidal Ecology embedded mitigation measures

ID	Environmental Measure Proposed	Project Phase Measure Introduced	How the Environmental Measures will be Secured	Relevance to Benthic and Intertidal Ecology Assessment
M001	The outputs of the project-specific site investigation surveys, will be reviewed to ensure that the final design and location of key project infrastructure takes full account of the physical environment and considers the potential for long-term changes. The mitigation hierarchy will be applied to avoid any sensitive areas identified, as far as is possible, by micro siting wind turbine generators (WTG) and cables.	This will be implemented in the pre-construction and construction phase of the Offshore Project.	To be secured through a condition of the Section 36 consent and/or Marine Licence.	Reduce impacts on sensitive benthic habitats (e.g., shellfish beds as well as habitat for spawning and feeding) through micro siting. For the purposes of the assessment, a potential reduction in impacts associated with avoiding sensitive habitats under this measure has not been assumed. The assessment applies a conservative worst-case scenario (i.e. assuming no avoidance is possible), as the extent to which sensitive areas can be avoided through micrositing cannot be quantified until detailed design and further site-specific investigations are completed.
M002	A Cable Installation Plan will be produced to confirm routing, method of installation and aspects such as target Depth of Burial and need for/location of/type of external cable protection. This Plan will also contain the outputs of a formal Cable Burial Risk Assessment (CBRA). Data from the project-specific geophysical surveys will be used to identify the preferred route, with the use of natural crevasses or channels within the bedrock proposed, where feasible, and areas of thicker Quaternary sediments identified (to maximise opportunities for cable burial).	This will be implemented in the pre-construction and construction phase of the Offshore Project.	Secured in the Section 36 Consent and/or Marine Licence conditions. Details will be provided within the Cable Installation Plan.	Reduce impacts to benthic habitats and associated communities by maximising cable burial and minimising suspended sediments. It will also reduce the potential release of sequestered blue carbon and impacts from scour, permanent habitat loss and EMF. For the purposes of the assessment of impacts on benthic ecology from EMF, the potential reduction in exposure associated with increased cable burial depth under this measure has not been taken into account. A conservative worst-case scenario (i.e. assuming burial depth cannot be increased beyond the minimum achievable, as outlined under the maximum design scenario in **Table 11-14** is applied, as the extent to which burial depth can ultimately be optimised to reduce EMF exposure cannot be determined until detailed design and further site-specific investigations are undertaken.
M003	Mitigation measures associated with Underwater Noise will be defined in a Marine Mammal Mitigation Protocol (MMMP), which will be developed prior to commencement of construction (**building on the Outline MMMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to.	Construction, operation (including maintenance), and decommissioning	To be secured through a condition of the Section 36 consent and/or Marine Licence via the condition for an MMMP to be submitted to MD-LOT for approval.	This will reduce the potential impacts from underwater noise generation on benthic receptors such as shellfish

ID	Environmental Measure Proposed	Project Phase Measure Introduced	How the Environmental Measures will be Secured	Relevance to Benthic and Intertidal Ecology Assessment
M004	Accidental release of construction material and/or litter to be addressed via the development of procedures to retrieve the accidental deposit of an object at sea.	Construction, operation (including maintenance), and decommissioning	To be secured through a condition of the Section 36 consent and/or Marine Licence.	This will reduce the potential impacts associated with unintended pollution, habitat disturbance / loss, and release of drilling fluids on benthic communities.
M005	Relevant best practice techniques for seabed excavations, employed through all phases of the Project, and suspended solids monitoring to aid responsible management of excavation activities.	This will be implemented during the construction phase of the Offshore project.	To be secured through a condition of the Section 36 consent and/or Marine Licence.	This will reduce potential impacts from increased suspended solids and sediment deposition, including disturbance to benthic habitats and the potential release of sequestered blue carbon.
M006	A Invasive Non-Native Species (INNS) Management Plan will be developed prior to commencement of construction (building on the **INNS Management Plan, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to.	This will be implemented during the construction, operational (including maintenance) and decommissioning phase of the Offshore Project.	Secured in the Section 36 Consent and/or Marine Licence conditions. Details will be provided within the INNS Management Plan	This will reduce the potential spread of INNS and will reduce the magnitude of any potential introductions to benthic habitats
M018	The mitigation hierarchy will be applied throughout each stage of design development to avoid and reduce potential likely significant effects on Important Ecological Features (IEFs).	This will be implemented in the pre-construction, construction, operation (including maintenance), and decommissioning phase of the Offshore Project.	To be secured through a condition of the Section 36 consent and/or Marine Licence.	This will reduce impacts to benthic ecology through reducing the potential size of impacts and avoiding sensitive areas where practicable.
M019	A final Offshore Environmental Management Plan (OEMP) will be developed prior to commencement of construction (building on **Outline OEMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to.	This will be implemented in the pre- construction and construction phase of the Offshore Project.	To be secured through a condition of the Section 36 consent and/or Marine Licence via the condition for an OEMP to be submitted to MD-LOT for approval.	This will reduce the potential impacts from habitat disturbance.
M020	A Decommissioning Plan will be developed prior to the construction of the Project in compliance with legislative requirements and/or best practice standards and guidance and adhered to.	Decommissioning	Secured in the Section 36 Consent and/or Marine Licence via the condition for a Decommissioning Plan to be submitted to MD-LOT for approval and the Energy Act 2004	Reduce impacts on benthic habitats and species through adhering to best practice standards and guidance during decommissioning activities.
M021	Adherence to requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78/. Best practice techniques employed through all phases of the Project, and measures provided in a Marine Pollution Contingency Plan (MPCP) (see **MPCP, Volume 3**). All vessels associated with the Project will comply with IMO/MCA codes for prevention of oil pollution and, where appropriate, will have onboard Shipboard Oil Pollution Emergency	This will be implemented during the construction, operation (including maintenance), and decommissioning phase of the Offshore Project.	Secured in the Section 36 Consent and/or Marine Licence conditions. Details will be provided within the MPCP	This will reduce any potential impacts from release of sediment bound contaminants (noting that such impacts have been scoped out of the assessment due to the low levels of contamination bring recorded in sediment as part of the surveys).

ID	Environmental Measure Proposed	Project Phase Measure Introduced	How the Environmental Measures will be Secured	Relevance to Benthic and Intertidal Ecology Assessment
	Plans (SOPEPs) (i.e. vessels over 400 gross tonnes (GT)).			
M023	Offshore construction within the Offshore Project Boundary will only be undertaken during the April-October period, except for offshore Landfall construction works located within the HDD Exit Pit Area.	Construction	To be secured through a condition of the Section 36 consent and/or Marine Licence.	Reduce impacts on benthic habitats and species by scheduling of construction reduce overall temporal disturbance.
M025	A final Operational & Maintenance (O&M) Plan (building on Outline Operational & Maintenance Plan, Volume 3) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to.	O&M	Secured in the Section 36 Consent and/or Marine Licence via the condition for an EMP to be submitted to MD-LOT for approval.	Manage and reduce impacts associated with operation and maintenance activities.
M054	To limit physical disturbance to the seabed, vessels will minimise the use of anchors, prioritising the use of dynamic positioning, where possible. This protocol will be of particular consideration around sensitive habitats.	This will be implemented during the construction, operation (including maintenance), and decommissioning phase of the Offshore Project.	To be secured through a condition of the Section 36 consent and/or Marine Licence.	This will reduce the impacts for temporary and permanent habitat loss.

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11.8 ASSESSMENT OF EFFECTS: CONSTRUCTION PHASE

11.8.1 TEMPORARY SEABED HABITAT LOSS AND/OR DISTURBANCE

11.8.1.1 Temporary habitat loss and/or disturbance will occur during the construction phase of the Offshore Project from activities such as ground clearance, seabed preparation, the use of jack up vessels and laying of cables.

11.8.1.2 Habitat disturbance will include structural changes to habitats due to the removal of boulders from WTG locations (through dragging along the seabed), and the proposed cable route; mechanical abrasion of seabed from cable movement and cable ploughing or jet trenching; as well as disturbance of the substrate from the deployment of stabilising legs of jack up barges.

11.8.1.3 Temporary habitat disturbance may change, disturb or alter habitats, which may subsequently affect the associated benthic community. Alternatively, a reduction in habitat suitability and availability of resources may result in displacement of fauna to other areas of varying suitability. This is more likely to affect sessile species that have limited mobility as opposed to more mobile species that are able to move away from potentially impacted areas.

11.8.1.4 The maximum design scenario relating to temporary habitat disturbance during the construction phase are presented in **Table 11-14**.

Magnitude

11.8.1.5 The magnitude of impact is based on the criteria detailed in Section 11.5 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-16**.

11.8.1.6 Based on the seabed disturbance activities outlined in the maximum design scenario detailed in **Table 11-14** the maximum amount of seabed disturbance anticipated is 12,480,875 m^2 (12.481 km^2). The Offshore Project Boundary (Array Area and OCAS) is 208 km^2, therefore there will be disturbance across <6% of the Offshore Project Boundary. The disturbance will be temporary and reversible in nature as construction activities will take place over a period of 5 years between 2028/2029 and 2032/2033. Construction activity within the Offshore Project Boundary is restricted to the months of April-October each year, except for Landfall construction works located within the HDD Exit Pit Area. Installation of WTG Foundations is limited to a 2 year consecutive period between April-October, totalling 14 months of active work.

11.8.1.7 A review commissioned by the Crown Estate examined the environmental recovery of subtidal sediments following cable installation, drawing on post-construction monitoring data from over 20 UK OWFs. The findings indicated that sandy sediments tend to recover rapidly, with cable trenches typically infilling soon after installation and leaving little observable disturbance in subsequent years. In contrast, residual trench features in coarse, mixed or muddy sediments were found to persist for longer, sometimes remaining visible for several years post-installation. However, these features were generally shallow (on the order of tens of centimetres deep), and the associated horizontal extent was limited to a few metres, meaning they did not represent a substantial deviation from baseline conditions (RPS, 2019). Sandy sediments are limited to the southwest corner of the Array Area. Coarse, mixed or muddy sediments are also limited across the Offshore Project Boundary, with only small pockets across the Array Area and within the southern part of the OCAS. The remainder of the Offshore Project Boundary comprise non sedimentary substrates including rock outcrop, cobbles and boulders that by their nature are not vulnerable to sediment disturbance.

11.8.1.8 The placement of jack-up vessel spud cans during foundation installation results in localised compression and indentation of seabed sediments. Evidence from post-construction monitoring at UK OWFs (e.g., Niras, 2008; EGS, 2011) indicates that these depressions naturally infill over time. At the Barrow Offshore Wind Farm, spud can footprints were nearly entirely infilled within 12 months (Niras, 2008). At the Lynn and Inner Dowsing sites, partial infilling was recorded, although shallow depressions (tens of centimetres deep) remained visible after a few years (EGS, 2011). In areas dominated by mobile sands or coarse sediments, these features are likely to be short-lived and may persist only for several months to a few years. Studies examining spud can penetration in layered soils demonstrate that penetration resistance increases in harder layers (e.g., stiff clay over sand), limiting the depth of penetration (Lee and Choo, 2024). Therefore, in areas with harder substrata, spud cans are expected to penetrate less deeply, creating shallower depressions. However, these may persist longer due to reduced sediment mobility.

11.8.1.9 Embedded Offshore Project mitigation measures are detailed within **Table 11-15** and include the commitment (M001, M002) to undertake pre-installation surveys and micro-siting of turbines and cable infrastructure in order to avoid sensitive areas, therefore the magnitude of impact is considered to be **Negligible** to **Low**.

11.8.1.10 The nature and location of the construction activities mean that disturbance to certain habitats such as kelp beds will be largely avoided. Furthermore, the majority of habitats present within the Offshore Project Boundary are present along multiple coastal regions of the UK. As a result, the changes to baseline conditions are considered to be within the range of natural variability or it is considered that there will partial loss and/or recoverable alteration to the extent, composition or character of a habitat/community, or population of a species, with recovery expected within less than 5 years. The range of magnitude of impact reflects the range of habitat disturbance expected during the construction phase.

Sensitivity or value of receptor

High value habitats

11.8.1.11 The following habitats have been assigned a high ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project. The sensitivity described for each receptors is based on the criteria provided in **Table 11-11**.

Annex I Bedrock and/or Stony Reef/Annex I bedrock and/or stony reef

11.8.1.12 Annex I Bedrock and/or Stony Reef/Annex I bedrock and/or stony reef is an overarching habitat description that covers a wide range of bedrock and stony reef habitats (10 separate biotopes). The habitat type A4.21 Echinoderms and crustose communities on circalittoral rock was found to occur over much of the Array Area, with smaller areas of A4.214 Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock. For the purpose of this chapter, the assessment has used the following subset of habitat types to determine sensitivity to this overarching habitat type as it contains the widest range of species:

- A4.214 Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock (Stamp *et al.,* 2023a);
- A3.116 Foliose red seaweeds on exposed lower infralittoral rock (Tillin *et al.,* 2023).

11.8.1.13 Biotopes representative of Annex I bedrock/stony reef have been assessed by MarLIN as having a low sensitivity to habitat disturbance in the form of abrasion/disturbance of the seabed (through cable laying/boulder clearance) (Stamp *et al*., 2023a, Tillin *et al*., 2023). The sensitivity has been derived from studies the aforementioned studies which have looked at the impacts from physical removal of species, which determined fragile species such as urchins have a lower tolerance to disturbance, in comparison to coraline algae and seaweeds. This is due to urchins being more susceptible to physical damage as they have a softer outer shell than encrusting species such as coraline algae and seaweeds are able to tolerate disturbance to a greater degree. Both habitat types are able to recover and recolonise following cessation of activities indicating a high recoverability. Therefore, the sensitivity to this impact is classed as **Low**.

Kelp Beds

11.8.1.14 Kelp beds have been assessed by MarLIN as having a medium sensitivity to habitat disturbance in the form of abrasion/disturbance of the seabed (Stamp *et al.,* 2023b). This sensitivity is derived from kelp beds having a low tolerance to abrasion and removal, with a medium ability to recover within 2-4 years following removal, however the epifaunal community it supports does not always return in this time. Therefore, the sensitivity to this impact is considered to be **Medium**.

Tide-swept algal communities

11.8.1.15 Tide-swept algal communities are considered by the FeAST tool to have a low sensitivity to habitat disturbance in the form of seabed abrasion (cable laying/site clearance/scour from suspended sediments) (FeAST, 2025b), due to a medium tolerance to damage and a high recoverability. More severe damage including the loss of algal holdfasts may increase the sensitivity of species. Therefore, the sensitivity to this impact is considered to be **Low**.

Offshore subtidal sands and gravels

11.8.1.16 Offshore subtidal sands and gravels are considered by the FeAST tool under the illustrative biotopes: A5.14 Circalittoral coarse sediment; A5.25 Circalittoral fine sand; and A5.26 Circalittoral muddy sand (continental shelf sands and continental shelf coarse sediments) to have a sensitivity ranging from negligible-high to disturbance in the form of seabed abrasion (cable laying, site clearance), which is dependent upon the species present (FeAST, 2023)[11]. The higher sensitivities are based upon the presence of more fragile sessile species that are not able to tolerate abrasion damage, and have a low recoverability, whereas the lower sensitivity is based upon tolerant species with a quick recovery time. Based upon the species present within the Offshore Project Boundary, the sensitivity to this impact is considered to be **Medium**.

***Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds**

11.8.1.17 A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment have been assessed by MarLIN as having a medium sensitivity to habitat disturbance in the form of seabed abrasion (cable laying, site clearance) (De-Bastos *et al*., 2023). This sensitivity is derived from brittle star species (which form the majority of individuals within this habitat) being able to tolerate and recover from some mechanical damage, however other more fragile species found within this biotope such as *Asterias rubens, Urticina felina,* and *Alcyonium digitatum* are not as tolerant to damage or able to recover as easily as brittlestar. Therefore, the sensitivity to this impact is considered to be **Medium**.

Blue Carbon Receptors

11.8.1.18 The value of blue carbon receptors is considered to be high. The MarLIN sensitivity scores of blue carbon receptors (kelp beds, and *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds) are medium in response to habitat disturbance in the form of abrasion/disturbance of the seabed. The sensitivity of blue carbon receptors to habitat disturbance is considered to be **Medium**.

[11] Please note that offshore subtidal sands and gravels have been removed from the 2025 version of FeAST due to its extensive nature, and to provide a more focussed and meaningful tool. Archived versions (v1/v2) that include offshore subtidal sands and gravels are available on request from NatureScot (FeAST, 2025c).

Low value habitats

11.8.1.19 The following habitats have been assigned a low ecological value, based upon criteria determined in Section 11.5.2 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project.

Circalittoral Mixed Sediments

11.8.1.20 A5.44 Circalittoral mixed sediments (continental shelf mixed sediments) are considered by the FeAST tool to have a medium sensitivity to disturbance in the form of seabed abrasion (cable laying, site clearance), which is dependent upon the ability of species present to tolerate damage and recover (FeAST, 2023)[12]. Therefore, the sensitivity to this impact is considered to be **Medium**.

***Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment**

11.8.1.21 A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment has been assessed by MarLIN as having a medium sensitivity to abrasion/disturbance of the seabed (Readman and Watson, 2024). Abrasion from fishing gear has been shown to damage emergent macrofauna such as hydroids, with increasing activity resulting in larger impacts to habitats and species. Disturbance from cable laying, abrasion and the footprint of jackup barge legs has the potential to be analogous to scour from fishing activity. The sessile nature of the species associated with this type of habitat also reduces their ability to tolerate repeated damage, however these species are able to recover from these impacts in the medium term. Therefore, the sensitivity to this impact is considered to be **Medium**.

Shellfish species

11.8.1.22 The following shellfish species have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of these shellfish to impacts from the construction phase of the Offshore Project.

Decapod crustaceans

11.8.1.23 There are 4 commercial species of decapod crustaceans that have been recorded within the Study Area, Norway lobster, brown crab, pink shrimp and squat lobster. The sensitivity of 2 species, Norway lobster and brown crab, have been used to determine the sensitivity of decapods found within the Offshore Project Boundary due to limited available data on the other species.

11.8.1.24 Norway lobster has been assessed by MarLIN as having a low sensitivity to physical disturbance (from activities such as cable laying, installation of turbines etc). This sensitivity is based upon a medium tolerance to disturbance and high recoverability as this species is able to re-establish burrows within 2 days of disturbance if individuals are not damaged (Hill and Sabatini, 2008;

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[12] Please note that circalittoral mixed sediments have been removed from the 2025 version of FeAST due to its extensive nature and to provide a more focussed and meaningful tool. Archived versions (v1/v2) that include circalittoral mixed sediments are available on request from NatureScot (FeAST, 2025c).

Sordalen *et al*., 2022; Vigo *et al*., 2023). Therefore, the sensitivity to this impact is considered to be **Low**.

11.8.1.25 Brown crab have been assessed by MarLIN as having a low sensitivity to physical disturbance (from activities such as cable laying, installation of turbines etc). This sensitivity is derived from a medium tolerance to disturbance due to the brittleness of their shells and a high recoverability due to reproductive strategy (Neal and Wilson, 2008). Therefore, the sensitivity of decapod crustaceans to temporary habitat disturbance is considered to be **Low**.

Common whelk

11.8.1.26 Common whelk are recorded as present around the whole of the UK, inhabiting a wide variety of habitat types from muddy-sand, to gravels and rocky substrates and at a range of water depths from the intertidal zone, down to depths of 1,200 m (Ager, 2008). Common whelk are reported to spend a large proportion of its time as an adult buried within soft substrates and remain within a localised area on the seabed, not exhibiting extensive movements (Valentinsson, 2002). The localised nature of this species and laying of egg cases on hard substrates, reduces the tolerance of this species to seabed abrasion to low however it has a medium recoverability due to its reproductive strategy. Therefore, the sensitivity of common whelk to temporary habitat disturbance is considered to be **Medium**.

Bivalve molluscs

11.8.1.27 There are 3 commercial species of bivalve, razor clam, king scallop and dog cockle that have been recorded within the Study Area, with the sensitivity of razor clams used as a proxy to determine the sensitivity of bivalves. Razor clam has been assessed by MarLIN as having a medium sensitivity to physical disturbance (from activities such as cable laying, installation of turbines etc). This sensitivity is derived from a low tolerance to physical disturbance due to the brittleness of their shells, which can result in mortality and a high recoverability due to recruitment potential (Hill, 2024). Recruitment within razor clam can be sporadic, therefore potential impacts from mortality events have the potential to take up to 5 years for recovery to occur (Hill, 2024). Therefore, the sensitivity of bivalve molluscs to temporary habitat disturbance is considered to be **Medium**.

Edible sea urchin

11.8.1.28 Edible sea urchin has been assessed by MarLIN as having a low sensitivity to physical disturbance (from activities such as cable laying, installation of WTGs etc). This sensitivity is derived from a medium tolerance to disturbance due to the brittleness of their tests, which can result in mortality, but a high recoverability due to the high fecundity of this species and ability to recover numbers rapidly (Tyler-Walters, 2008). Therefore, the sensitivity of edible sea urchin to temporary habitat disturbance is considered to be **Low**.

Cuttlefish

11.8.1.29 Cuttlefish have been assessed by MarLIN as having a medium sensitivity to physical disturbance from activities such as cable laying, abrasion from cable and movement of rock (Gibson-Hall and Wilson, 2018). This is based on their soft bodies which are susceptible to damage, despite adults having the ability to avoid areas of disturbance. Furthermore, if disturbance occurs following the laying of eggs, this could impact the population by the removal of future cohorts resulting in a medium tolerance. This species, however, has a medium ability to recover due to its high fecundity, and therefore it is able to replace losses if successful recruitment events occur. Therefore, the sensitivity of cuttlefish to temporary habitat disturbance is classed as **Medium**.

Significance of effect

11.8.1.30 Temporary habitat disturbance in the form of abrasion is anticipated to take place during the construction phase of the Offshore Project. Considering the embedded mitigation measures described in **Table 11-15**, the effects of temporary habitat disturbance on Benthic and Intertidal Ecology receptors are summarised in **Table 11-16**.

Table 11-16: Significance of effect of temporary habitat loss and/or disturbance to Benthic Ecology receptors during the construction phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I Bedrock and/or Stony Reef	Low	High	Low	M001, M002, M054	**Negligible**	Not significant	The spatial extent of the impact is limited. Habitat is present along the coastline of multiple areas around the UK. Species recorded within this habitat are also adapted to living on bedrock and other hard substrate. As a result, the area of habitat affected by temporary seabed habitat loss and/or disturbance is small. Disturbance is considered reversible with recovery expected within 5 years.
Kelp beds	Low	High	Medium	M001, M002, M005, M054	Short-term, direct, reversible, **Minor adverse**	Not significant	HDD beneath the intertidal zone will ensure the majority of kelp beds within the Offshore Project Boundary are avoided. Kelp beds are present along the coastline of Scotland/*Alba* and are not restricted to the Offshore Project Boundary. As a result, the area of habitat

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							affected by temporary seabed habitat loss and/or disturbance is small and disturbance is considered reversible with recovery expected within 5 years.
Tide-swept algal communities	Low	High	Low	M001, M002, M005, M054	**Negligible**	Not Significant	Mainly located in the intertidal zone. The use of HDD beneath the intertidal zone will ensure that the majority of tide-swept algal communities within the Offshore Project Boundary are avoided. Tide-swept algal communities are present along the coastline of Scotland and are not restricted to the Offshore Project Boundary. As a result, the area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Offshore subtidal sands and gravels	Negligible	High	Medium	M001, M002, M005,	**Negligible**	Not Significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
				M054			the UK coastline and not restricted to the Offshore Project Boundary. The area of habitat affected is small and any changes in baseline conditions are considered to be within the range of natural variability.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Medium	M001, M002, M005, M054	Short-term, direct, reversible, **Minor adverse**	Not Significant	The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Circalittoral mixed sediments	Negligible	Low	Medium	M001, M002, M005, M054	**Negligible**	Not Significant	This habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. The area of habitat affected is small and any changes in baseline conditions are considered to be within the range of natural variability.
Flustra foliacea and	Low	Low	Medium	M001, M002,	Short-term, direct, reversible, **Minor adverse**	Not Significant	This habitat is characterised as occurring on pebbles and

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Hydrallmania falcata on tide-swept circalittoral mixed sediment				M005, M054			cobbles. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Decapod crustaceans	Low	Medium	Low	M001, M002, M005, M054	**Negligible**	Not Significant	The area of habitat which support these species is considered small. Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Common whelk	Low	Medium	Medium	M001, M002, M005, M054	Short-term, direct, reversible, **Minor adverse**	Not Significant	The area of habitat which support these species is considered small. Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Bivalve molluscs	Low	Medium	Medium	M001, M002, M005, M054	Short term, direct, reversible, **Minor adverse**	Not Significant	The area of habitat which support these species is considered small. Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years. Bivalve species identified within the Offshore Project Boundary require areas of soft sediment. Avoidance of these areas (where practicable) will further reduce the potential for adverse impacts.
Edible sea urchin	Low	Medium	Low	M001, M002, M005, M054	**Negligible**	Not Significant	The area of habitat which support these species is considered small. Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with

Receptor	**Magnitude**	**Value**	**Sensitivity**	**Embedded mitigation measures**	**Significance of effect**	**Significance**	**Commentary**
							recovery expected within 5 years.
Cuttlefish	Low	Medium	Medium	M001, M002, M005, M054	Short-term, direct, reversible, **Minor adverse**	Not Significant	The area of habitat which support these species is considered small. Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Blue carbon receptors *(kelp beds, brittle star beds)*	Low	High	Medium	M001, M002, M005, M054	Short-term, direct, reversible, **Minor adverse**	Not Significant	See commentary above for 'kelp beds'.

Further Environmental Mitigation and Residual Effect

11.8.1.31 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.8.2 TEMPORARY INCREASE IN SUSPENDED SEDIMENT CONCENTRATION AND TURBIDITY

11.8.2.1 During the Offshore Project construction phase, a number of activities have the potential to result in elevated levels of suspended solids within the Offshore Project Boundary, these include: cable burial (Array Cables to Final WTG and Array Cables to Landfall), WTG foundation pile drilling and HDD Exit Pit Construction. The potential impacts as a result of HDD drilling cutting release in addition to multiple activities from HDD construction activities (both HDD Exit Pit construction and release of drilling fluids) has been assessed separately in Section 11.8.5. The levels of suspended solids generated by these activities have been described in **Chapter 9, Volume 2a** and **Chapter 10, Volume 2a**. The worst-case scenario for generation of suspended solids has been used in this assessment and is described in **Chapter 10, Volume 2a**. The maximum design scenario relating to temporary increase in SSCs and turbidity during the construction phase are presented in **Table 11-14**.

Magnitude

11.8.2.2 The magnitude of impact is based on the criteria detailed in Section 11.5 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-17**.

11.8.2.3 Construction activities within the Offshore Project Boundary will take place over a 5-year period between 2028/29-2032/33, with works restricted to April-October each year, except for Landfall construction works within the HDD Exit Pit Area (which can occur year-round). Works will be paused between November-March to account for winter conditions.

11.8.2.4 The installation of the wind turbine foundations involving excavation and the laying of cables has the potential to result in mobilisation of sediment, with jet trenching producing the highest levels of mobilised sediment, however this method is only practical on softer sediments.

Cable installation

11.8.2.5 Jet trenching in the southwest of the Array Area has the potential to result in increased SSCs plumes of up to 450 m wide and up to 100 mg/l that in the worst case could be transported up to 10 km from the source (**Chapter 9, Volume 2a**). This is due to predominantly fine silt/clay sediments being present in the southwest. In the central and northeast Array Area sandy substrates are predominantly present, thus, plumes of suspended sediments up to 500 m wide with concentrations of up to 300 mg/l could disperse up to 500 m from the source (**Chapter 9, Volume 2a**). This is due to predominantly fine sandy sediment being present centrally and in the northeast.

11.8.2.6 Within the OCAS jet trenching has the potential to result in increased SSCs plumes of above 350 mg/l and in discrete circumstances up to 840 mg/l which could disperse up to 200 m from release point and remain in suspension less than 15 minutes due to coarse sediment size within the OCAS (**Chapter 9, Volume 2a).** Elevated levels of suspended solids are likely to be confined to within the bottom 1–2 m of the water column (**Appendix 9.2, Volume 2c**).

11.8.2.7 The impacts of cable burial activities from adjacent cables may occur within the OCAS as this is where Array Cables to Landfall will be located in close proximity to each other (in comparison to the Array Cables to Final WTGs). In the case of suspended sediment concentrations, maximum values occur at the location of the cable burial and decrease rapidly with distance in the direction of the tidal current. Assuming that cables are buried equally spaced at 150 m across the width of the OCAS (2 km), the impacts of adjacent cables are not expected to be greater than the maximum impacts along the individual cables. This is based on the model between Landfall and the Array Area indicating a potential zone of influence of approximately 100 m centred on the cable burial route (see **Appendix 9.2**, **Volume 2c**).

Drilling of the WTG jacket pile foundations

11.8.2.8 Sediment plumes associated with the drilling of pin piles are expected to be between 5 mg/l and <40 mg/l. Once the sediment is released during drilling, it remains in suspension within the water column for ~1-12 hours after completion of drilling (**Chapter 9, Volume 2a**).

Multiple activities - drilling of piles to install wind turbine generator foundations and cable burial

11.8.2.9 In addition to the activities considered individually above, multiple activities have also been assessed and modelled to determine maximum suspended sediment concentration and sediment deposition thickness concentration arising during the drilling of pin piles and cable burial activities. These activities, which have been assumed to occur sequentially within the Array Area, have been modelled as a maximum design scenario (see paragraph 9.1.7.5 and Section 4.6 of **Appendix 9.2, Volume 2c** for further details).

11.8.2.10 The maximum suspended sediment concentration during drilling of 4 WTG foundations (each with 4 piles), and burial of cables (assuming drilling and cable burial activities happen sequentially) per month, was modelled in the southwest Array Area, buried channel and northeastern area of the Array Area.

11.8.2.11 Overall, the combined extent of suspended sediment concentrations is mainly constrained to the Turbine Area, however the SSC plume does extend outside the Turbine Area by approximately 3 km in the southwest corner of the Turbine Area (see **Plate 4-32** in **Appendix 9.2, Volume 2c**).

11.8.2.12 When considering the drilling of pin piles to install WTG Foundations and burial of Array Cables to Final WTG, the worst-case scenario in terms of increase in suspended sediment concentration results from the southwest drilling of piles to install WTG foundations and sequential Array Cables to Final WTG burial, reaching up to 450 mg/l for a brief period (less than hour) within 500 m and will exceed the background concentration of 0.5 mg/l for around 13 days within 500m. This will exceed the 25 mg/l threshold for around 3 days and exceeds background concentrations of 0.5 mg/l for around 13 days.

Exit pit construction

11.8.2.13 Sediment plumes associated with the construction of HDD exit pits are expected to range between 350 mg/l (within 200 m of HDD exit pit construction) and 1,000 mg/l (within 1 km of HDD exit pit construction) for coarse and fine sediment respectively. SSCs are expected to be elevated above baseline condition for up to 2 days for the full range of sediment sizes.

Summary

11.8.2.14 Sediment transport will be temporary in nature and reversible with modelling predicting that peak sediment concentrations could remain in the water column for a period of up to 2 days. Following cessation of activities, suspended sediments will return to normal levels due to the prevailing currents and wave action within the Offshore Project Boundary. Therefore, the magnitude of change from baseline levels caused from turbine installation and cable laying and burial activities is likely to be **Negligible** to **Low**. This is because changes to baseline conditions are considered to be within the range of natural variability or partial loss and/or recoverable alteration to the extent, composition or character of a habitat/community, or population of a species, with recovery expected to be within 5-10 years. The range of magnitude of impact reflects the range of habitat disturbance expected during the construction phase.

Sensitivity or value of receptor

High value habitats

11.8.2.15 The following habitats have been assigned a high ecological value, based upon criteria determined in Section 11.5.3. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project. The sensitivity described for each receptors is based on the criteria provided in **Table 11-11**.

Annex I Bedrock/Stony reef

11.8.2.16 Annex I bedrock/stony reef has been assessed by MarLIN as having a low (Stamp *et al.,* 2023a) – medium (Tillin *et al.,* 2023) sensitivity to increases in suspended solids. This range of sensitivity is due to habitats encompassing suspension feeders, which feed on dissolved organic matter and phytoplankton, along with an ability to eject sediment particles, these have a high tolerance and high recoverability to increases in suspended solids. In comparison, algal species that rely upon sunlight for photosynthesis have a low tolerance and medium recoverability. This is because light penetration within the water column is reduced by increased suspended solids subsequently impacting photosynthetic ability in algal species. Therefore, the sensitivity to this impact is classed as **Medium**.

Kelp Beds

11.8.2.17 Kelp beds have been assessed by MarLIN as having a medium sensitivity to changes in SSCs (Stamp *et al.,* 2023b). This sensitivity is derived from a low tolerance and medium recoverability to these conditions. This is due to increased suspended solids impacting the ability of kelp to photosynthesise, by reducing light penetration within the water column. Studies have reported that higher suspended solid concentrations can be a limiting factor in the depth at which kelp can colonise due to decreased light penetration (from 35 m down to 1-2 m). Therefore, the sensitivity to this impact is considered to be **Medium**.

Tide-swept algal communities

11.8.2.18 Tide-swept algal communities are considered by the FeAST tool to have a low sensitivity to changes in suspended sediments (FeAST, 2025b). This is based upon algal communities dependence on light penetration for photosynthesis which can be impacted by increases is suspended solids (indicating a low tolerance), however these communities typically have a high recoverability following disturbance events. Therefore, the sensitivity to this impact is considered to be **Low**.

Offshore subtidal sands and gravels

11.8.2.19 Offshore subtidal sands and gravels under the illustrative biotopes: A5.14 Circalittoral coarse sediment; A5.25 Circalittoral fine sand; A5.26 Circalittoral muddy sand (continental shelf sands and continental shelf coarse sediments) are considered by the FeAST tool to have a negligible sensitivity to increases in suspended sediments (changes to water clarity) (FeAST, 2023)[11]; and therefore high tolerance and recoverability. This is due to the hydrological conditions these habitats are located within influences the scale and duration of increases of suspended sediments. Therefore, the sensitivity to this impact is considered to be **Negligible**.

Ophiothrix fragilis **and/or** ***Ophiocomina nigra*** **brittlestar beds on sublittoral mixed sediment**

11.8.2.20 A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment have been assessed by MarLIN as having a negligible sensitivity to increases in SSCs (De-Bastos *et al.,* 2023). This sensitivity is derived from brittlestars being passive suspension feeders which rely upon suspended organic matter as a food source and thus have a high tolerance and recoverability to increases in suspended solids. High increases in turbidity could reduce feeding efficiency on phytoplankton, however it also could potentially result in additional organic matter suspended in the water column, adding a further food resource. Therefore, the sensitivity to this impact is considered to be **Negligible**.

Blue Carbon Receptors

11.8.2.1 The value of blue carbon receptors is considered to be high. The sensitivity scores of blue carbon receptors have been assessed and range from negligible (*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds) and medium (kelp beds), in response to increases in SSCs. The sensitivity of blue carbon receptors to increases in response to SSCs is considered to be **Medium**, accounting for the higher sensitivity of kelp beds.

Low value habitats

11.8.2.2 The following habitats have been assigned a low ecological value, based upon criteria determined in Section 11.5.2 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project.

Circalittoral mixed sediments

11.8.2.3 A5.44 Circalittoral mixed sediments (continental shelf mixed sediments) are considered by the FeAST tool to have a medium sensitivity to changes in suspended sediments (FeAST, 2023)[12]. This is attributed to the habitat and its associated species having a range of tolerances to increases in suspended sediments, as well as a range in ability to recover. Therefore, using a precautionary approach, the sensitivity to this impact is considered to be **Medium**.

***Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment**

11.8.2.4 A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment has been assessed by MarLIN as having a negligible sensitivity to increases in suspended solids (Readman and Watson, 2024). This is due to some of the species being suspension feeders and their likely ability to recover within several days indicating a high tolerance and recoverability. Furthermore, the conditions where these habitats reside are characterised by strong tidal flows and wave action, which reduces the residence time for sediment within the water column. Therefore, their sensitivity to this impact is considered to be **Negligible.**

Shellfish receptors

11.8.2.5 The following shellfish species have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of these shellfish to impacts during the construction phase of the Offshore Project. An increase in suspended sediments has the potential to impact benthic ecology and shellfish receptors, through changing levels of light penetration, clogging gills, reducing prey availability and causing mobile species such as decapods to relocate, which could increase the potential for predation. Sessile species and those that filter feed are more likely to be impacted by increases in SSCs as they have reduced ability to avoid these areas.

Decapod crustaceans

11.8.2.6 A total of 4 species of decapod crustaceans has been recorded within the Survey Area, Norway lobster, brown crab, pink shrimp and squat lobster. Of these species, 2, Norway lobster and brown crab, have been used to determine the sensitivity of decapods found within the Offshore Project Boundary.

11.8.2.7 Norway lobster have been assessed by MarLIN as having a negligible sensitivity to increases of suspended solids of up to 100 mg/l for a period of up to 1 month (Hill and Sabatini, 2008). This is due to their highly mobile nature which enables them to move to other areas if required; and they are not reliant on suspended sediment for prey. Consequently, they are expected to have high tolerance; thus, their sensitivity to this impact is considered to be **Negligible.**

11.8.2.8 Brown crab have been assessed by MarLIN as having a low sensitivity to increases of suspended solids of up to 100 mg/l for a period of up to 1 month (Neal and Wilson, 2008). Brown crab are visual predators, therefore an increase in suspended solids has the potential to impair feeding, although conversely, they also feed upon filter feeders, which may be impacted by increased suspended solids (through reduced condition due to starvation), which may lead to increased predation success for Brown crab. There is also potential for a reduction in brown crab predators, thus, the benefits of increased suspended solids potentially outweigh the negatives for this species. Therefore, the sensitivity of decapod crustaceans to temporary increases in SSCs is considered to be **Low**.

Common whelk

11.8.2.9 Common whelk are recorded as present around the whole of the UK, inhabiting a wide variety of habitat types from muddy-sand, to gravels and rocky substrates and at a range of water depths from the intertidal zone, down to depths of 1200 m (Ager, 2008). Common whelk are known to exhibit both active hunting and scavenger behaviours, predating upon slow moving benthic species such as brittlestar and scavenging seabed carrion, locating food items through a scent trail (Valentinsson, 2002). The wide range of habitats common whelk inhabit, and its ability to use other cues such as scent to find food, indicates it has a high tolerance/adaptation to living in conditions influenced by suspended sediments, therefore its sensitivity to temporary increases in suspended solids is considered to be **Low**.

Bivalve molluscs

11.8.2.10 There are 3 commercial species of bivalve, razor clam, king scallop and dog cockle that have been recorded within the Survey Area, with the sensitivity of razor clams being used to determine the sensitivity of bivalves. Razor clams have been assessed by MarLIN as having a low sensitivity to increases of suspended solids of up to 100 mg/l for a period of up to 1 month (Hill, 2024). This is attributed to their high tolerance to increases in suspended solids, provision of an additional food source in dissolved organic matter and high recoverability. Prolonged decreases in suspended solid concentrations have the potential to impair growth and fecundity, especially if it leads to a reduction in food supply (marine microalgae and dissolved and particulate organic matter) (Hill, 2024). Therefore, the sensitivity to temporary increases in suspended solids is considered to be **Low**.

Edible sea urchin

11.8.2.11 Edible sea urchin has been assessed by MarLIN as having a negligible sensitivity to increases of suspended solids of up to 100 mg/l for a period of up to 1 month (Tyler-Walters, 2008). This sensitivity is derived from a high tolerance and very high recoverability to increases in suspended solids. The main impacts from increased suspended solids on edible sea urchin is derived from impacts to its preferred food source, kelp, which can be impacted through changes to the light regime. Sea urchins are readily able to switch food sources from kelp to microalgae and particulate organic matter. Therefore, their sensitivity to this impact is considered to be **Negligible**.

Cuttlefish

11.8.2.12 Cuttlefish have been assessed by MarLIN as having a negligible sensitivity to increases in SSCs (Gibson-Hall and Wilson, 2018). This sensitivity is derived from a high tolerance to increases in suspended solids and a high recoverability. Cuttlefish are visual predators, therefore increased suspended sediments have the potential to impair feeding, however the species is able to capture prey in the dark, therefore impacts are likely to be reduced. Furthermore, increases in suspended solids have the potential to provide camouflage for this species and reduce predation by other species. Therefore, the sensitivity to this impact is considered to be **Negligible.**

Significance of effect

11.8.2.13 Construction activities are anticipated to generate increased suspended sediment and turbidity in the water column. Considering the embedded mitigation described in **Table 11-15**, the effects of a temporary increase in SSC and turbidity on Benthic and Intertidal Ecology receptors are detailed in **Table 11-17**.

Table 11-17: Significance of effect of temporary increase in suspended sediment concentrations to Benthic and Intertidal Ecology receptors during the construction phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Medium	M005	Short-term, direct, reversible, **Minor adverse**	Not significant	Annex I bedrock and/or stony reef typically occur in areas characterised by high tidal action, and consequently often have reduced levels of soft sediments, reduced durations of suspended sediment and frequent re-suspension of deposited sediment over a short period of time. Species recorded within this habitat are typically adapted to living in high energy conditions with low but frequent levels of suspended sediments which therefore reduces the potential impact. High value Annex I reef habitat is present within the Offshore Project Boundary but represents a small proportion of the wider regional resource. Predicted impacts are

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							short-term, localised and reversible, limited to temporary increases in suspended sediment during construction, with no permanent loss or alteration of reef structure. Although of high conservation importance, this habitat typically occurs in high-energy tidal environments and associated communities are adapted to natural sediment re-suspension and dynamic conditions. Vulnerability to temporary, small-scale sediment disturbance is therefore low to moderate. The resulting effect is Minor adverse and Not Significant in EIA terms.
Kelp beds	Low	High	Medium	M005	Short-term, direct, reversible, **Minor adverse**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							Area, thus reducing the potential impact.
Tide-swept algal communities	Low	High	Low	M005	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Offshore subtidal sands and gravels	Negligible	High	Negligible	M005	**Negligible**	Not significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of the UK coastline and not restricted to the Offshore Project Boundary. Changes to baseline conditions are considered to be within the range of natural variability.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Negligible	M005	**Negligible**	Not significant	The area of habitat affected is small and impacts are considered reversible with recovery expected within 5 years
Circalittoral mixed sediments	Negligible	Low	Medium	M005	**Negligible**	Not significant	This habitat is present along the coastline of multiple areas around

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							the UK and is not restricted to the Offshore Project Boundary. Changes to baseline conditions are considered to be within the range of natural variability.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Negligible	M005	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Decapod crustaceans	Low	Medium	Low	M005	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Common whelk	Low	Medium	Low	M005	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							reversible with recovery expected within 5 years.
Bivalve molluscs	Low	Medium	Low	M005	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Edible sea urchin	Low	Medium	Negligible	M005	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Cuttlefish	Low	Medium	Negligible	M005	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Blue carbon receptors (*kelp beds, brittlestar beds*).	Low	High	Medium	M005	Short-term, direct, reversible, **Minor adverse**	Not significant	See commentary above for 'kelp beds'.

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Further Environmental Mitigation and Residual Effect

11.8.2.14 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.8.3 TEMPORARY INCREASE IN SEDIMENT DEPOSITION FROM MOBILISED SEDIMENT

11.8.3.1 During the Offshore Project construction phase, a number of activities have the potential to result in increasing levels of sediment deposition from mobilised sediment within the Offshore Project Boundary, these include: cable burial (Array Cables to Final WTG/ and Array Cables to Landfall), WTG foundation pile drilling and HDD Exit Pit construction. The potential impacts as a result of HDD drilling cutting release in addition to multiple activities from HDD construction activities (both HDD Exit Pit construction and release of drilling fluids) has been assessed separately in Section 11.8.5. The levels of suspended solids generated by these activities have been described in **Chapter 9, Volume 2a**. The maximum design scenario relating to temporary increase in sediment deposition from mobilised sediment during the construction phase are presented in **Table 11-14**.

Magnitude

11.8.3.2 The magnitude of impact is based on the criteria detailed in Section 11.5 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-18**.

11.8.3.3 Construction activities within the Offshore Project Boundary will take place over a 5-year period between 2028/29-2032/33, with works restricted to April-October each year, except for Landfall construction works within the HDD Exit Pit Area (which can occur year-round). Works will be paused between November-March to account for winter conditions.

11.8.3.4 The installation of the wind turbine foundations involving excavation and the laying of cables has the potential to result in mobilisation of sediment and subsequent sediment deposition, with jet trenching producing the highest levels of mobilised sediment, however this method is only practical on softer sediments.

Cable installation

11.8.3.5 The construction of the Array Cables to Final WTG has the potential to result in deposition of mobilised sediment to a depth of 10 cm within the immediate vicinity (<400 m) of construction activity (due to the coarse nature of the sediment present), however the deposition from this activity is generally predicted to be less than 1 cm at a maximum distance of 5 km. The sediment within the Turbine Area is frequently re-mobilised due to wave action and tidal currents (see **Chapter 9, Volume 2a** and **Appendix 9.2, Volume 2c**), therefore the areas of deposition are likely to return to baseline conditions rapidly after deposition. Therefore, the impact is expected to be localised, reversible and short-term in nature with an overall magnitude of **Low**.

11.8.3.6 The construction of the Array Cables to Landfall has the potential to result in a maximum level of deposition of 10 cm occurs in the immediate vicinity (<100 m) of the Array Cable to Landfall burial. Generally, deposition thicknesses resulting from Array Cable to Landfall installation is less than 1 cm at a maximum distance of 250 m (see **Chapter 9, Volume 2a**, and **Appendix 9.2, Volume 2c**). The sediment within the Array Cables to Landfall route is frequently re-mobilised due to wave action and tidal currents, therefore the areas of deposition are likely to return to baseline conditions rapidly after deposition. Therefore, the impact is expected to be localised, reversible and short-term in nature with an overall magnitude of **Low**.

Drilling of the WTG jacket pile foundations

11.8.3.7 The WTG foundation works has the potential to result in a maximum, sediment deposition of 30 cm within the immediate vicinity of the turbine foundations (<1 km), with deposition generally being restricted to less than 1 cm (see **Chapter 9, Volume 2a**). The sediment within the Turbine Area is frequently re-mobilised due to wave action and tidal currents, therefore the areas of deposition are likely to return to baseline conditions rapidly after deposition. Therefore, the impact is expected to be localised, reversible and short-term in nature with an overall magnitude of **Low**.

Multiple activities - drilling of piles to install wind turbine generator foundations and cable burial

11.8.3.8 In addition to the activities considered individually above, multiple activities have also been assessed and modelled to determine maximum suspended sediment concentration and sediment deposition thickness concentration arising during the drilling of pin piles and cable burial activities. These activities, which have been assumed to occur sequentially within the Array Area, have been modelled as a maximum design scenario (see paragraph 9.1.7.5 and Section 4.6 of **Appendix 9.2, Volume 2c** for further details).

11.8.3.9 The maximum suspended sediment concentration during drilling of 4 WTG foundations (each with 4 piles), and burial of cables (assuming drilling and cable burial activities happen sequentially) per month, was modelled in the southwest Array Area, buried channel and northeastern area of the Array Area.

11.8.3.10 When considering the maximum sediment deposition from the modelling of multiple activities (drilling of pin piles to install WTG Foundations and burial of Array Cables to Final WTG), deposition does not exceed the deposition from individual activities given the temporal and spatial variation between activities in relation to the tidal cycle, and potential for resuspension of sediment between subsequent activities.

Exit pit construction

11.8.3.11 The construction of the HDD Exit Pits has the potential to result in sediment deposition of between 3 cm (within 400 m of HDD exit pit construction) and 7 mm (within 500 m of HDD exit pit construction) for coarse and fine sediment respectively (see **Chapter 9, Volume 2a**). The sediment is frequently re-mobilised due to wave action and tidal currents, therefore the areas of deposition are likely to return to baseline conditions rapidly after deposition. Therefore, the impact is expected to be localised, reversible and short-term in nature with an overall magnitude of **Low**.

Summary

11.8.3.12 Therefore the overall magnitude of impact from all construction activities that could increase sediment deposition relating to the Offshore Project, taking into account all embedded mitigation (included in **Table 11-15**), is likely to be localised, reversible and short-term in nature with an overall magnitude of **Low.** This is because changes to baseline conditions are considered to be within the range of natural variability or due to partial loss and/or recoverable alteration to the extent, composition or character of a habitat/community, or population of a species, with recovery expected within less than 5 years. The range of magnitude of impact reflects the range of habitat disturbance expected during the construction phase.

Sensitivity or value of receptor

11.8.3.13 Increases in deposition of suspended sediments have the potential to impact Benthic and Intertidal Ecology receptors, through smothering of habitats and sessile organisms, clogging gills, reducing prey availability and causing mobile species such as decapods to relocate which could increase the potential for predation. Habitats and sessile organisms are more likely to be impacted by smothering than mobile species, which are able to avoid areas of increased sediment deposition or to excavate themselves from sediment deposits.

High value habitats

11.8.3.14 The following habitats have been assigned a high ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project. The sensitivity described for each receptors is based on the criteria provided in **Table 11-11**.

Annex I bedrock/stone reef

11.8.3.15 Annex I bedrock/stoney reef has been assessed by MarLIN as having a negligible sensitivity to low sediment deposition (up to 5 cm) and a low sensitivity to heavy siltation (up to 30 cm) (Stamp *et al.,* 2023a, Tillin *et al.,* 2023). This sensitivity is based upon the ability of the species comprising this habitat type to tolerate increases in sediment deposition and their ability to recover from sediment deposition, in addition these habitats are found within areas of moderate wave action and currents, which results in the continual and rapid resuspension of deposited sediments. Therefore, the sensitivity to this impact is considered to be **Low**.

Kelp beds

11.8.3.16 Kelp beds have been assessed by MarLIN as having a low sensitivity to increased sediment deposition (Stamp *et al.,* 2023b), indicating that they have the ability to tolerate changes in levels of sediment deposition and recover within a short period of time. These habitats are not sensitive to levels of deposition up to 5 cm, with a low sensitivity to deposition of up to 30 cm. These habitats are typically located in areas of moderate flow and wave action, with deposited sediment likely to be continually and rapidly remobilised, and therefore unlikely to persist in the area. Therefore, the sensitivity to this impact is considered to be **Low**.

Tidal swept algal communities

11.8.3.17 Tidal swept algal communities are considered by the FeAST tool to have a low sensitivity to increased sediment deposition (FeAST, 2025b), indicating that they have the ability tolerate potential changes to levels of sediment deposition and recover within a short period of time. These habitats are not sensitive to levels of deposition up to 5 cm, with a low sensitivity to deposition of up to 30 cm. Adult algae are less sensitive to sediment deposition than juveniles and spores as they tend to be larger specimens which are rarely fully smothered. These habitats are typically located in areas of moderate flow and wave action, therefore deposited sediment is likely to be remobilised quickly and unlikely to persist within the Offshore Project Boundary. Therefore, the sensitivity to this impact is considered to be **Low**.

Offshore subtidal sands and gravels

11.8.3.18 Offshore subtidal sands and gravels under the illustrative biotopes: A5.14 Circalittoral coarse sediment; A5.25 Circalittoral fine sand; A5.26 Circalittoral muddy sand (described on FeAST as continental shelf sands and continental shelf coarse sediments) are considered by the FeAST tool to have a medium sensitivity to light sediment deposition (up to 5 cm) (FeAST, 2023)[11]. The FeAST tool considers continental coarse sediment to have a medium sensitivity to heavy sediment deposition (between 5-30 cm) and continental shelf sand to have a high sensitivity to heavy sediment deposition. As such, they are expected to demonstrate medium tolerance and recoverability. Therefore, the sensitivity to this impact is considered to be **Medium**.

Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment

11.8.3.19 A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment has been assessed by MarLIN as having a medium sensitivity to smothering of up to 5 cm, due to the presence of the species occurring within this habitat type (De-Bastos *et al.,* 2023). This sensitivity is derived from the habitat’s limited ability to tolerate potential changes to levels of sediment deposition and high recoverability. Increased levels of sediment deposition have the potential to impair filter and suspension feeding; as well as impairing respiration through the clogging of gills. Therefore, the sensitivity to this impact is considered to be **Medium**.

Blue Carbon Receptors

11.8.3.20 The value of blue carbon receptors is considered to be high. The sensitivity scores of blue carbon receptors have been assessed and range from medium (*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds) and low (kelp beds), in response to sediment deposition. The sensitivity of blue carbon receptors to increases in response to sediment deposition is considered to be **Medium**, accounting for the higher sensitivity of brittlestar beds.

Low value habitats

11.8.3.21 The following habitats have been assigned a low ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project. The sensitivity described for each receptors is based on the criteria provided in **Table 11-11**.

Circalittoral mixed sediments

11.8.3.22 A5.44 Circalittoral mixed sediments (continental shelf coarse mixed sediments) are considered by the FeAST tool to have a negligible sensitivity to light sediment deposition of up to 5 cm, but with a medium sensitivity to heavy levels of deposition up to 30 cm (FeAST, 2023)[12]. As such, they are expected to demonstrate medium tolerance and recoverability. Therefore, the sensitivity to this impact is considered to be **Medium**.

***Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment**

11.8.3.23 A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (Readman and Watson 2024) has been assessed by MarLIN as having a negligible sensitivity to levels of deposition up to 5 cm (light), with a low sensitivity to deposition of up to 30 cm (heavy). The sensitivity is derived from a high tolerance and recoverability from light sediment deposition and a medium tolerance to heavy sediment deposiiton. This is due to increased sediment deposition impacting the ability of species present to feed, however the areas in which these habitats occur are often categorised by moderate flow, therefore deposited material is often rapidly dispersed. Therefore, the sensitivity to this impact is considered to be **Low**.

Shellfish species

11.8.3.24 The following shellfish species have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of the habitats to temporary increases in sediment deposition during the construction phase of the Offshore Project.

Decapod crustaceans

11.8.3.25 There are 4 species of decapod crustaceans that have been recorded within the Survey Area; Norway lobster, brown crab, pink shrimp and squat lobster. The sensitivity of 2 species; Norway lobster and brown crab, have been used to determine the sensitivity of decapods found within the Offshore Project Boundary.

11.8.3.26 Norway lobster have been assessed by MarLIN as having a negligible sensitivity to increases in sediment deposition indicating they have the ability tolerate potential changes to levels of sediment deposition and have a high recovery ability (Hill and Sabbatini, 2008). Their mobile nature enables them to avoid areas of increased sediment deposition and to extract themselves from areas of deposited sediment.

11.8.3.27 Brown crab have been assessed by MarLIN as having a negligible sensitivity to increases in sediment deposition, indicating an ability to tolerate potential changes in sediment levels, with a high recovery ability (Neal and Wilson, 2008). Similarly, their mobile nature enables them to avoid areas of increased sediment deposition and to extract themselves from areas of deposition. Therefore, the sensitivity of decapod crustaceans to increases in sediment deposition is considered to be **Negligible**.

Common whelk

11.8.3.28 Common whelk are present around the whole of the UK, inhabiting a wide variety of habitat types from muddy-sand, to gravels and rocky substrates and at a range of water depths from the intertidal zone, down to depths of 1200 m (Ager, 2008). Common whelk are reported to spend a large proportion of its time as an adult buried within soft substrates when not feeding (Valentinsson, 2002). The reproductive strategy within common whelk includes internal fertilisation within females and the deposition of egg cases upon hard substrate, where the development of juvenile whelk takes place. These life history aspects suggest a high tolerance to sediment deposition and the ability to recover in adults; with a medium tolerance for whelk eggs, giving an overall high tolerance to sediment deposition. Due to its adaptations for remaining buried within sediment when not feeding, it is likely that common whelk has a **Low** sensitivity to increases in sediment deposition.

Bivalve molluscs

11.8.3.29 There are 3 commercial species of bivalve, razor clam, king scallop and dog cockle that have been recorded within the Survey Area, with the sensitivity of razor clams used to determine the sensitivity of bivalves. Razor clam has been assessed by MarLIN as having a negligible sensitivity to increases in sediment deposition. This indicates, they have the ability tolerate changes to levels of sediment deposition and recover within a short time period (Hill, 2024). This species has the ability to extract itself from areas of deposited sediment and they are adapted to living in sedimentary substrates, which can be subject to a regular influx of sediments. Therefore, the sensitivity to this impact is considered to be **Negligible**.

Edible sea urchin

11.8.3.30 Edible sea urchin has been assessed by MarLIN as having a low sensitivity to increases in sediment deposition, indicating they have the ability tolerate potential changes to levels of sediment deposition and recover within a short-time period (Tyler-Walters, 2008). This species is reported to have a negligible sensitivity to smothering by sediment to a 5 cm depth for a period of up to 1 month, with low sensitivity to smothering up to 30 cm. This is enabled by their mobile nature, ability to avoid areas of increased sediment deposition and ability to extract themselves from areas of deposited sediment. Therefore, the sensitivity to this impact is considered to be **Low**.

Cuttlefish

11.8.3.31 Cuttlefish have been assessed by MarLIN as having a negligible sensitivity to light (> 5 cm) and heavy (> 30 cm) levels of sediment deposition (Gibson-Hall and Wilson, 2018). Similarly, this highly mobile species has the ability to avoid areas of deposition. Juveniles are also able to extricate themselves from deposited sediment and as eggs are deposited on floating structures off the seabed, they are unlikely to be impacted by increased sediment deposition. Furthermore, juvenile cuttlefish actively bury themselves in coarse sediments to avoid predation. As such, they are considered to have a high tolerance. Therefore, the sensitivity to this impact is considered to be **Negligible**.

Significance of effect

11.8.3.32 Construction activities are anticipated to generate temporary increases in SSCs and associated sediment deposition within the Offshore Project Boundary. These increases are directly related to seabed disturbance from installation works, such as cable laying and foundation installation. However, due to the prevailing metocean conditions, sediment that is deposited is expected to be remobilised rapidly by tidal currents and wave action. As a result, the duration will be temporary, and the extent of construction-related sediment deposition will be limited. The influence of natural hydrodynamic processes on sediment transport in the area is described in detail in **Chapter 9, Volume 2a**. Considering the embedded mitigation measures detailed in **Table 11-15** the effects of a temporary increase in sediment deposition from mobilised sediment on Benthic and Intertidal Ecology receptors are detailed in **Table 11-18**.

Table 11-18: Significance of effect of temporary increase in sediment deposition from mobilised sediment to Benthic and Intertidal Ecology receptors during the construction phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Low	M005	**Negligible**	Not significant	Habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. This habitat occurs in areas characterised by tidal action, which will reduce the duration of suspended sediments and will re suspend deposited sediments over a short period of time, thus reducing the potential impact. Impacts are considered reversible within 5 years.
Kelp beds	Low	High	Low	M005	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact. Impacts are considered reversible within 5 years.
Tide-swept algal communities	Low	High	Low	M005	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact. Impacts are considered reversible within 5 years.
Offshore subtidal sands and gravels	Low	High	Medium	M005	Short-term, direct, reversible, **Minor adverse**	Not significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of the UK coastline and not restricted to the Offshore Project Boundary. Impacts are considered reversible within 5 years.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Medium	M005	Short-term, direct, reversible, **Minor adverse**	Not significant	The area of habitat affected is small and impacts are considered reversible with recovery expected within 5 years
Circalittoral mixed sediments	Low	Low	Medium	M005	Short-term, direct, reversible, **Minor adverse**	Not significant	This habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. Impacts are considered reversible within 5 years.

Receptor	**Magnitude**	**Value**	**Sensitivity**	**Embedded mitigation measures**	**Significance of effect**	**Significance**	**Commentary**
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Low	M005	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact. Impacts are considered reversible within 5 years.
Decapod crustaceans	Low	Medium	Negligible	M005	**Negligible**	Not significant	The short-term nature of the works and the type of sediment deposited (coarse sand and gravels) is likely to reduce the potential for adverse impacts, as coarser sediments have larger interstitial spaces, and therefore have more water exchange with the overlying water column, reducing the potential for anoxic conditions. Impacts are considered reversible within 5 years.
Common whelk	Low	Medium	Low	M005	**Negligible**	Not significant	The area of habitat which support these species is considered small. The impact is not anticipated to lead to changes to the population of species.

Receptor	**Magnitude**	**Value**	**Sensitivity**	**Embedded mitigation measures**	**Significance of effect**	**Significance**	**Commentary**
							The impact is considered reversible with recovery expected within 5 years.
Bivalve molluscs	Low	Medium	Negligible	M005	**Negligible**	Not significant	The area of habitat which support these species is considered small. The impact is not anticipated to lead to changes to the population of species. The impact is considered reversible with recovery expected within 5 years.
Edible sea urchin	Low	Medium	Low	M005	**Negligible**	Not significant	The area of habitat which support these species is considered small. The impact is not anticipated to lead to changes to the population of species. The impact is considered reversible with recovery expected within 5 years.
Cuttlefish	Low	Medium	Negligible	M005	**Negligible**	Not significant	The area of habitat which support these species is considered small. The impact is not anticipated to lead to changes to the population of species. The impact is considered reversible with recovery expected within 5 years.
Blue carbon receptors *(brittlestar beds, kelp beds)*.	Low	High	Medium	M005	Short-term, direct, reversible, **Minor adverse**	Not significant	See commentary above for ‘kelp beds’.

Further Environmental Mitigation and Residual Effect

11.8.3.33 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.8.4 DISTURBANCE FROM UNDERWATER NOISE AND VIBRATION

11.8.4.1 During the construction phase of the Offshore Project a number of activities have the potential to generate underwater noise and associated vibration, most notable piling activity associated with the installation of the wind turbine foundations. The effects of underwater noise on marine mammal and fish species have been extensively studied over the last few decades, however impacts to invertebrate species (including shellfish) is not as well understood. It is also recognised that shellfish species have a lower sensitivity to underwater noise and vibration than marine mammals and fish due to differences in their physiology, including the lack of a gas filled spaces within their bodies (Popper *et al*., 2001). Research has shown that invertebrates are able to sense sound/particle waves through organs that evolved to allow them to maintain their equilibrium in the water and sense gravity (Solé *et al*., 2023), however how underwater noise and vibration impacts these species is not as well recorded.

11.8.4.2 The production of underwater noise and vibration through construction activities has the potential to impact shellfish species through changes to behaviour and in some cases including cessation of burrowing, closing of valves or avoiding areas of noise (Solan *et al.,* 2016), result in injury or mortality if in close proximity to piling activities. The maximum design scenario relating to disturbance from underwater noise and vibration generated during piling and cable route preparation during the construction phase are presented in **Table 11-14**.

Magnitude

11.8.4.3 The magnitude of impact is based on the criteria detailed in Section 11.5 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-19**.

11.8.4.4 The maximum design scenario for percussive piling noise generation is described in full in **Table 11-14**, with a maximum hammer energy of 5,000 kJ and piling duration of up to 5.5 hours per 24-hour period over a 2 year period, albeit not continuously (see **Appendix 3.1, Volume 1c** for further details).

11.8.4.5 Details of the modelling approach and outputs of the potential noise levels generated construction activities, most notably impact piling during the construction phase has been reported in **Appendix 13.3, Volume 2c**. However, it should be noted that criteria for the thresholds in sound pressure at which effects (e.g. mortality, auditory injury, recoverable injury, disturbance and/or behavioural effects) may occur, have been produced for marine mammals (Southall *et al.,* 2019) and fishes (Popper *et al.,* 2014). These are not applicable to invertebrates that generally rely on the detection of particle motion. Given the paucity of particle motion data and difficulties in calculating it from pressure (Nedelec *et al*., 2021), as well as the small number of studies of noise impacts for such a diverse group, no accepted thresholds for noise effects on aquatic invertebrates exist. Therefore, this chapter has taken a qualitative approach to assessing the impacts of underwater noise on shellfish receptors.

11.8.4.6 **Chapter 12, Volume 2a** has assumed that a magnitude of low to medium for disturbance from underwater noise will be produced based upon the results from **Appendix 13.3, Volume 2c.** However, it should be noted that fish species are more sensitive to noise than shellfish due to differences in physiology, with shellfish species likely being more sensitive to vibration than noise. Therefore the overall magnitude of impact from all construction activities that could generate underwater noise and vibration relating to the Offshore Project, taking into account all embedded mitigation (included in **Table 11-15**), is likely to be localised, reversible and medium-term in nature with an overall magnitude of **Low**. This is because of partial loss and/or recoverable alteration to the extent, composition or character of a habitat/community, or population of a species, with recovery expected within less than 5 years.

Sensitivity or value of receptor

11.8.4.7 Due to the fact that hearing/perception of noise/vibration requires specialised organs/gas filled cavities, only shellfish receptors have been taken forward for impact assessment, with habitats excluded. This approach is supported by sensitivity assessments from FeAST and MarESA which show that tide-swept algal communities exhibit low sensitivity to underwater noise and vibration and benthic habitats generally show negligible sensitivity to acoustic disturbance (FeAST, 2025b; MarLIN, 2023). The sensitivity described for each receptor is based on the criteria provided in Section 11.5.3 and **Table 11-11**.

Decapod Crustaceans

11.8.4.8 Studies undertaken by Solan *et al.* (2016) investigating the impacts of underwater noise on Norway lobster, reported that exposure to underwater noise resulted in reduced activity (movement and burrowing) and clearing of burrows compared to control experiments, indicating a behavioural response, however there were no records of mortality. Based upon changes to behaviour caused by anthropogenic noise, but no recorded mortality, the sensitivity to this impact is considered to be **Medium**.

Common Whelk

11.8.4.9 Limited information is available on the sensitivity of common whelk to underwater noise. However, emerging research has found that over the long term, shipping noise can negatively affect the locomotor capacity of common whelk, constraining dispersal (Uboldi *et al.,* 2025). It is reasonable to assume that the impacts of underwater noise from shipping are comparable if not of a smaller magnitude to that caused by piling and cable route preparation. Therefore, the sensitivity to this impact is considered **Low**.

Bivalve molluscs

11.8.4.10 Limited information is available on dog cockle, king scallop and razor clam species, however studies have investigated the impacts of underwater noise on the Manila clam *Ruditapes philippinarum* reported increased valve closures, reduced feeding and lower position in the sediment, however no mortality was recorded (Solan *et al.,* 2016). As this species inhabits similar habitats to razor clam and dog cockle it is suitable to use as a proxy for bivalve molluscs. Based upon changes to behaviour caused by anthropogenic noise, but no recorded mortality, and considering the evidence of tolerance and recoverability, the sensitivity to this impact is considered to be **Low**.

Edible sea urchin

11.8.4.11 A review by MarLIN of the sensitivity of edible sea urchin to noise found that there is no evidence to suggest that echinoderms are sensitive to sound or vibration (Tyler-Walters 2008). Therefore, the sensitivity to this impact is considered to be **Negligible**.

Cuttlefish

11.8.4.12 Cuttlefish has been assessed by MarLIN as having a medium sensitivity to underwater noise (Gibson-Hall and Wilson 2018). This sensitivity is derived from a medium tolerance and medium ability to recover following exposure to underwater noise. Cuttlefish are thought to be able to habituate to some levels of noise exposure, but it can cause changes to behaviour (including avoidance of areas) and above thresholds of 139-142 dB, damage to statocysts may occur. Therefore, the sensitivity to this impact is considered to be **Medium**.

Significance of effect

11.8.4.13 Piling and cable route preparation activities during construction is anticipated to generate underwater noise and vibration. Considering the embedded mitigation measures described in **Table 11-15,** the effects of disturbance from underwater noise and vibration generated during piling and cable route preparation on Benthic and Intertidal Ecology receptors are detailed in **Table 11-19**.

Table 11-19: Significance of effect of disturbance from underwater noise and vibration generated during piling and cable route preparation to shellfish receptors during the construction phase

Receptor	**Magnitude**	**Value**	**Sensitivity**	**Embedded mitigation measures**	**Significance of effect**	**Significance**	**Commentary**
Decapod crustaceans	Low	Medium	Medium	M003	Medium-term, direct, reversible, **Minor adverse**	Not significant	There is limited evidence to suggest mortality is caused by exposure to underwater noise, exposure may have sub-lethal effects including changes in behaviour and cessation of feeding. It should also be noted that piling will not be continuous and will not be across the whole Offshore Project Boundary, thus reducing potential impacts. As a result, the impact is not anticipated to lead to changes to the population level, and the impact is considered reversible within 5 years.
Common whelk	Low	Medium	Low	M003	**Negligible**	Not significant	Piling works will not be continuous or be undertaken across the whole Offshore Project Boundary, which will reduce the potential for impacts. As a result, the impact is not anticipated to lead to changes to the population level, and the impact is considered reversible within 5 years.
Bivalve molluscs	Low	Medium	Low	M003	**Negligible**	Not significant	There is limited evidence to suggest mortality is caused by exposure to underwater noise, exposure may have sub-lethal effects including changes in behaviour and cessation of feeding. It should also be noted that piling will not be continuous and will not be across the whole Offshore Project Boundary, thus reducing potential impacts. As a result, the impact is

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							not anticipated to lead to changes to the population level, and the impact is considered reversible within 5 years.
Edible sea urchin	Low	Medium	Negligible	M003	**Negligible**	Not significant	There is no current evidence that suggests echinoderms are sensitive to sound or vibration. The impact is not anticipated to lead to changes to the population level, and the impact is considered reversible within 5 years.
Cuttlefish	Low	Medium	Medium	M003	Medium-term, direct, reversible, **Minor adverse**	Not significant	There is evidence that exposure to underwater noise can result in injury and changes to behaviour in cuttlefish, however there is no direct evidence of mortality. It should also be noted that piling will not be continuous and will not be across the whole Offshore Project Boundary, thus reducing potential impacts. As a result, the impact is not anticipated to lead to changes to the population level, and the impact is considered reversible within 5 years.

Further Environmental Mitigation and Residual Effect

11.8.4.14 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.8.5 RELEASE OF DRILLING FLUID MUD, DRILLING ARISINGS OR BENTONITE

11.8.5.1 In order to reduce potential impacts to species and habitats susceptible to effects relating to the release of drilling fluid (this includes the intertidal zone and kelp beds within the Offshore Project Boundary) Array Cables to Landfall will be installed beneath the intertidal zone using HDD. Installation will occur at the Landfall Exit Pit Area located, approximately 500-1,500 m offshore in water depths of 15-25 m MSL.

11.8.5.2 Although direct habitat loss will be greatly reduced by using HDD, there is the potential for other impacts to arise, including from the release of bentonite and other material following breakout at the HDD Exit Pit location. Bentonite is a natural mineral, and the only impacts from its release into the water column are from increased suspended sediment. The maximum design scenario relating to release of drilling fluid mud, drilling arisings or bentonite from HDD activities within the Landfall Exit Pit Area are presented in **Table 11-14**.

Magnitude

11.8.5.3 The magnitude of impact is based on the criteria detailed in Section 11.5 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-20**.

11.8.5.4 Sediment transport modelling detailed in **Chapter 9, Volume 2a**, examined a worst-case accidental release of drilling fluid, assuming the volume (1,285 m^3) of the largest HDD bore which will be discharged over a 1-hour period. The drilling fluid is assumed to contain up to 27% fine sediment equating to a maximum sediment release rate of approximately 230 kg/s. Under this scenario, peak SSC values are predicted to reach ~1,000 mg/l during both spring and neap tides. These elevated concentrations are localised (with the greatest concentrations of suspended solids being limited to less than 1 km of the release point during spring tide and 300 m during neap tide); remaining in suspension for one tidal cycle (~12 hours); and rapidly dispersed by tidal currents, resulting in reduced sediment deposition.

11.8.5.5 Sediment transport modelling indicates a maximum sediment deposition thickness of up to 7 mm within 500 m of the HDD construction activity and will largely be confined within 2 m height of the seabed (**Appendix 9.2, Volume 2c**). Up to 4 km from the site sediment deposition thickness is typically less than 1 mm. Tidal and wave action is expected to remobilise deposited sediments quickly (typically within 2 days) as stated in **Appendix 9.2, Volume 2c**, reducing persistence on the seabed.

11.8.5.6 The modelling assessed the release of drilling fluid from a single HDD exit pit, although up to 13 HDD exit pits will be drilled based upon the maximum design scenario. Based on prevailing sediment transport conditions, both suspended and deposited sediments are expected to return to background levels within 2 days. Given the staggered nature of HDD installation, no cumulative increase in SSC or seabed deposition is anticipated from successive installations. Further details are provided in **Chapter 9, Volume 2a**.

Multiple activities - HDD construction activities (both release of drilling fluid and exit pit construction

11.8.5.7 Multiple activities to assess cumulative SSC and associated deposition resulting from sequential HDD exit pit construction and release of drilling fluid from HDD has also been considered (see Section 4.6.2 in **Appendix 9.2, Volume 2c**). For HDD exit pit construction, the same maximum design scenario described in Section 11.8.2 and 11.8.3 applies to the cumulative assessment.

11.8.5.8 If multiple HDD construction activities occur within 2 days, then there could be accumulation of suspended sediment within 1 km of the activities. Suspended sediment concentrations are expected to return to baseline conditions within 2 days of a construction activity taking place. This is based on a worst-case assumption that the activities are aligned in the direction of the tidal current (i.e. the direction where sediment advection distances are the largest).

11.8.5.9 The potential impacts of sediment deposition from multiple activities occurring in a single location or multiple locations have been considered in **Appendix 9.2, Volume 2c**.

11.8.5.10 In a single location, the worst-case sediment deposition thickness from multiple activities (i.e. exit pit construction and release of drilling fluid) is limited by the by the natural re-mobilisation of sediments by tidal currents and waves. The maximum deposition thickness resulting from HDD exit pit construction or drill cutting release is 7 mm for fine sediments. The sediment will be re-mobilised by tidal currents and waves under normal conditions so preventing accumulation even where activities overlap. For coarse sediments, combined deposition from overlapping HDD exit pit construction and release of drilling fluids could reach up to 4 cm. This will be limited to the location where the HDD exit pit and release of drill cuttings overlap.

11.8.5.11 Sediment may accumulate due to multiple activities occurring in multiple locations within the Exit Pit Area. Sediment deposition thickness decreases with distance from the construction activity in the direction of the tidal current. Sediment deposited due to release of drill cuttings is assumed to be re-mobilised by tidal currents and waves in normal conditions so is expected to not accumulate significantly across different locations. This also applies to fine sediments released by HDD exit pit construction. For coarser sediments released by HDD exit pit construction, sediment could accumulate by up to a maximum of 3 cm per HDD exit pit within 400 m of each other if 100%

of the sediment is assumed to be coarse, and the HDD exit pit locations are directly aligned in the direction of the tidal current.

11.8.5.12 Given the short duration, localised spatial extent, low deposition depths, and rapid recovery of baseline conditions, the magnitude of impact is considered to be **Negligible** to **Low**. The range of magnitude of impact reflects the range of habitat disturbance expected during the construction phase. This is because changes to baseline conditions are considered within the range of natural variability or due to partial loss and/or recoverable alteration to the extent, composition or character of a habitat/community, or population of a species with recovery expected within 5 years.

Sensitivity or value of receptor

11.8.5.13 The main impact from release of drilling fluid mud, drilling arisings or bentonite from HDD is the increase in SSCs following breakout. There will be some sediment deposition, however due to the tidal regime and wave action, deposited sediment will be remobilised within 1-2 days. Therefore, the sensitivity of Benthic and Intertidal Ecology receptors to increased sediment concentrations has been used as per Section 11.8.2. The release of this material has the potential to result in localised changes to SSCs and sediment deposition. Changes in levels of SSCs and sediment deposition have the potential to result in reduced feeding efficiency in suspension feeding organisms, reduced photosynthetic ability, clogging of gills and feeding apparatus, smothering of sessile organisms and inducing behavioural changes in mobile species.

Significance of effect

11.8.5.14 The use of HDD to bore under the intertidal zone will occur during the construction of the Offshore Project. This process will release drilling fluid mud, drilling arisings and/or bentonite into the water column. Considering the embedded mitigation described in **Table 11-15**, the effects of the release of drilling fluid drilling arisings and/or bentonite on Benthic and Intertidal Ecology receptors are detailed in **Table 11-20**, with the sensitivity described for each receptors being based on the criteria provided in **Table 11-11**.

Table 11-20: Significance of effect of release of drilling fluid mud, drilling arisings or bentonite from HDD employed at the cable landfall location to Benthic and Intertidal Ecology receptors during the construction phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Medium	M004	Short-term, direct, reversible, **Minor adverse**	Not significant	Habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. This habitat occurs in areas characterised by tidal action, which will reduce the duration of suspended sediments and will re suspend deposited sediments over a short period of time, thus reducing the potential impact. Impacts are considered reversible within 5 years.
Kelp beds	Low	High	Medium	M004	Short-term, direct, reversible, **Minor adverse**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact. Impacts are considered reversible within 5 years.
Tide-swept algal communities	Low	High	Low	M004	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the duration of suspended sediments and will re suspend deposited sediments over a short period of

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							time, thus reducing the potential impact. Impacts are considered reversible within 5 years.
Offshore subtidal sands and gravels	Negligible	High	Negligible	M004	**Negligible**	Not significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of the UK coastline and not restricted to the Offshore Project Boundary. Changes to baseline conditions are considered to be within the range of natural variability.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Negligible	M004	**Negligible**	Not significant	The area of habitat affected is small and impacts are considered reversible with recovery expected within 5 years
Circalittoral mixed sediments	Negligible	Low	Medium	M004	**Negligible**	Not significant	This habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. Changes to baseline conditions are considered to be within the range of natural variability.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Negligible	M004	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							reducing the potential impact. Impacts are considered reversible within 5 years.
Decapod crustaceans	Low	Medium	Low	M004	**Negligible**	Not significant	The area of habitat which support these species is considered small. Impact is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Common whelk	Low	Medium	Low	M004	**Negligible**	Not significant	The area of habitat which support these species is considered small. Impact is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Bivalve molluscs	Low	Medium	Low	M004	**Negligible**	Not significant	The area of habitat which support these species is considered small. Impact is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Edible sea urchin	Low	Medium	Negligible	M004	**Negligible**	Not significant	The area of habitat which support these species is considered small. Impact is not anticipated to lead to changes to the population of species. The disturbance of

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							supporting habitat is considered reversible with recovery expected within 5 years.
Cuttlefish	Low	Medium	Negligible	M004	**Negligible**	Not significant	The area of habitat which support these species is considered small. Impact is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.

Further Environmental Mitigation and Residual Effect

11.8.5.15 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.8.6 INTRODUCTION AND COLONISATION OF INFRASTRUCTURE BY INVASIVE NON-NATIVE SPECIES

11.8.6.1 The introduction of INNS through changes to habitat type and construction of infrastructure as well as increased vessel traffic has the potential to impact Benthic and Intertidal Ecology receptors. The introduction of INNS has the potential to result in changes to species composition, increased competition for resources (including space and food sources) and potential increased predation on native species. The following receptor appraisals are broadly informed by INNS assessments published by NRW (Tillin *et al.*, 2020) unless otherwise stated. The maximum design scenario relating to introduction and colonisation of infrastructure by INNS during the O&M phase are presented in **Table 11-14**.

Magnitude

11.8.6.2 The magnitude of impact is based on the criteria detailed in Section 11.5 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-21**.

11.8.6.3 The introduction of INNS is recognised as a potential risk during construction of the Offshore Project. Vectors for INNS introduction include:

- Vessel movements (hull fouling and niche areas such as sea chests, propellers, anchors, and bilge systems);
- Ballast water discharge from international or inter-regional vessels;
- Construction equipment and subsea infrastructure, which may act as artificial substrates for colonisation;
- Import or transfer of construction materials such as rock bags, rock berms or concrete units that could harbour attached organisms or propagules.

11.8.6.4 To reduce these risks, the Applicant will develop and adhere to an INNS Management Plan (see **Invasive Non-Native Species Management Plan, Volume 3**), which will include measures consistent with the International Maritime Organization's Ballast Water Management Convention, Marine Scotland's guidance on INNS (MD-LOT, 2018), and best practice biosecurity protocols (GB NNSS, 2015) (see **Table 11-15**). This will include hull and ballast water management, inspection and cleaning of construction equipment prior to mobilisation, and controls on the source and transfer of materials. These measures will substantially reduce the potential for new INNS to be introduced, or existing INNS to be spread. With this in mind, it is not possible to rule out the risk of introduction/spread of INNS entirely, however, field studies of cables indicate that hard substrates are introduced, colonization of the provided new habitat is by endemic, rather than invasive fauna; with the majority of non-native species seen in the intertidal zone (OSPAR, 2023) (a localized portion of the Offshore Project).

11.8.6.5 Following the mitigation measures set out in the INNS Management Plan, the introduction and subsequent risk of INNS is considered unlikely. Therefore, it is anticipated the magnitude of impact to Benthic and Intertidal Ecology receptors will be **Low**. This is due to partial loss and/or recoverable alteration to the extent, composition or character of a habitat/community, or population of a species.

Sensitivity or value of receptor

High value habitats

11.8.6.6 The following habitats have been assigned a high ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project. The sensitivity described for each receptor is based on the criteria provided in **Table 11-11**.

Annex I bedrock/stoney reef

11.8.6.7 Annex I bedrock/stoney reef has been assessed by MarLIN as having a negligible sensitivity to the introduction of INNS, however this is based on the assessment for foliose red seaweeds on exposed lower infralittoral rock. This sensitivity is based upon the conditions these habitats are often recorded in (water depth and wave exposure) being sub-optimal for INNS species such as *Sargassum* (recorded within the Study Area, Section 11.6.1.2) and *Undaria*, with native species being adapted to these conditions, thus reducing competition from INNS (Tillin *et al.*, 2023). Therefore, the sensitivity to this impact is considered to be **Negligible**.

Kelp beds

11.8.6.8 Kelp beds have been assessed by MarLIN as having a negligible sensitivity to the introduction of INNS (Stamp *et al.*, 2023b). This sensitivity has been derived from field studies that have monitored competition between native kelp species, *Laminaria hyperborea* and 2 common invasive marine algae; *Undaria pinnatifida* and *Sargassum muticum* (which has been recorded within the Study Area, see Section 11.6.1.2). The studies reported that *Sargassum* prefers sheltered conditions and is unable to grow in conditions with moderate wave action, therefore *Sargassum* will not be able to compete with kelp beds, which are usually found in exposed conditions. The studies also reported that *Undaria* is more commonly found on artificial structures than *Laminaria* and unable to colonise dense kelp beds due to competition with established species. The studies determined that kelp beds have a high tolerance and recoverability to the introduction of INNS. Therefore, the sensitivity to this impact is considered to be **Negligible**.

Tide-swept algal communities

11.8.6.9 Tide-swept algal communities are considered by the FeAST tool to have a low sensitivity to introductions of INNS (FeAST, 2025b). FeAST has determined that this habitat has a medium tolerance and high recoverability to the introduction of INNS. This is based upon observations of competition between *Sargassum* and native species including sea oak *Halidrys siliquosa*. It was observed that *Sargassum* is more vigorous than *Halidrys*, however *Sargassum* dies back in winter, whereas *Halidrys* does not allowing *Halidrys* to compete with *Sargassum*. *Sargassum* does reduce the coverage of *Halidrys*, but *Halidrys* is able to recover from this competition. Therefore, the sensitivity to this impact is considered to be **Low**.

Offshore subtidal sands and gravels

11.8.6.10 Offshore subtidal sands and gravels are considered by the FeAST tool to have a medium sensitivity to the introduction of INNS (FeAST, 2023)[11]. This sensitivity is based upon the evidence that some INNS species such as slipper limpets *Crepidula fornicata* (not recorded in the Study Area), pacific oyster (recorded within the Study Area, see Section 11.6.1.2) and others are able to outcompete native species and proliferate; equating to a medium tolerance. Therefore, the sensitivity to this impact is considered to be **Medium**.

***Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment**

11.8.6.11 A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment have been assessed by MarLIN as having a medium sensitivity to the introduction of INNS (De-Bastos *et al.,* 2023). This sensitivity has been derived from the low resilience of this type of habitat to tolerate invasive species such as slipper limpet, which has the potential to outcompete native species by forming dense aggregations and by the medium recoverability of brittlestar beds. Therefore, the sensitivity to this impact is considered to be **Medium**.

Low value habitats

11.8.6.12 The following habitats have been assigned a low ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project. The sensitivity described for each receptors is based on the criteria provided in **Table 11-11**.

Circalittoral mixed sediments

11.8.6.13 A5.44 Circalittoral mixed sediments (continental shelf mixed sediments) are considered by the FeAST tool to have a high sensitivity to introductions of INNS (FeAST, 2023)[12]; equating to potentially low tolerance and recovery. Therefore, the sensitivity to this impact is considered to be **High**.

***Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment**

11.8.6.14 A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment has been assessed by MarLIN as having a medium sensitivity introduction of INNS (Readman and Watson, 2024). MarLIN has assessed this habitat as having a medium tolerance and low recoverability to the introduction of INNS. This is based upon examples, where INNS species such as the American slipper limpet or the invasive bryozoan *Schizoporella japonica* have dominated this type of habitat and outcompeted native species, however currents and tidal energy may limit the colonisation of some INNS. Therefore, the sensitivity to this impact is considered to be **Medium**.

Shellfish species

11.8.6.15 The following shellfish species have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of these shellfish species to impacts from the construction phase of the Offshore Project.

Decapod crustaceans

11.8.6.16 For the 4 decapod species (Norway lobster, brown crab, pink shrimp and squat lobster) and using the sensitivity of brown crab, MarLIN assigned no sensitivity to the introduction of INNS. As this species is not known to compete with or be impacted by the introduction of non-native species (Neal and Wilkinson, 2008), therefore the sensitivity to this impact is considered to be **Negligible**.

Common whelk

11.8.6.17 Limited information is available on the sensitivity of common whelk to the introduction of INNS. Current regional evidence synthesed for *B. undatum* emphasise fisheries and environmental drivers as principal pressures and do not identify INNS as a key threat (DEFRA Whelk FMP Evidence Statement, 2023). However, due to their widespread nature and life history they are likely to have a naturally high tolerance, and thus a low sensitivity to INNS. Therefore, as a precautionary measure, the sensitivity of common whelk to the introduction of INNS is considered to be **Low**.

Bivalve molluscs

11.8.6.18 For the 3 commercial species of bivalve (razor clam, king scallop and dog cockle), using the sensitivity of razor clams, MarLIN assigned a low sensitivity to the introduction of INNS (Hill, 2024. Razor clam are infaunal species found in sandy to muddy substrates, therefore introduction of INNS colonising hard substrates will not be competing directly with this species; equating to a high tolerance. Therefore, the sensitivity of razor clam to the introduction of INNS is considered to be **Low**.

Edible sea urchin

11.8.6.19 Edible sea urchin has been assessed by MarLIN as having no sensitivity to the introduction of INNS as this species is not known to compete with or be impacted by the introduction of non-native species (Tyler-Walters, 2008), therefore the sensitivity to this impact is considered to be **Negligible**.

Cuttlefish

11.8.6.20 Limited information is available on the sensitivity of Cuttlefish to the introduction of INNS. Cuttlefish are a predatory species and therefore the introduction of INNS could provide an additional food source for this species, however the introduction of a predatory species could result in impacts to cuttlefish eggs. Therefore, as a precautionary measure, the sensitivity of cuttlefish to the introduction of INNS is considered to be **Low**.

Significance of effect

11.8.6.21 Construction activities have the potential to introduce INNS into the environment which could then colonise the Offshore Project infrastructure. Considering the embedded mitigation measures described in **Table 11-15**, the effects of the potential introduction and colonisation of INNS on Benthic and Intertidal Ecology receptors are detailed in **Table 11-21**.

Table 11-21: Significance of effect of the introduction and colonisation of infrastructure by invasive non-native species to Benthic and Intertidal Ecology receptors during the construction phase

Receptor	**Magnitude**	**Value**	**Sensitivity**	**Embedded mitigation measures**	**Significance of effect**	**Significance**	**Commentary**
Annex I Bedrock and/or Stony Reef	Low	High	Negligible	M006	**Negligible**	Not significant	Changes to baseline conditions within the range of natural variability.
Kelp beds	Low	High	Negligible	M006	**Negligible**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.
Tide-swept algal communities	Low	High	Low	M006	**Negligible**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.
Offshore subtidal sands and gravels	Low	High	Medium	M006	Long-term, non-reversible, indirect, **Minor adverse**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Medium	M006	Long-term, non-reversible, indirect, **Minor adverse**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Circalittoral mixed sediments	Low	Low	High	M006	Long-term, non-reversible, indirect, **Minor adverse**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Medium	M006	Long-term, non-reversible, indirect **Minor adverse**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.
Decapod crustaceans	Negligible	Medium	Negligible	M006	**Negligible**	Not significant	Changes to baseline conditions within the range of natural variability.
Common whelk	Low	Medium	Low	M006	**Negligible**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the coming or population of species, with reversal of impacts anticipated within 5 years.
Bivalve molluscs	Low	Medium	Low	M006	**Negligible**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the coming or population of species, with reversal of impacts anticipated within 5 years.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Edible sea urchin	Low	Medium	Negligible	M006	**Negligible**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the coming or population of species, with reversal of impacts anticipated within 5 years.
Cuttlefish	Low	Medium	Low	M006	**Negligible**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the coming or population of species, with reversal of impacts anticipated within 5 years.

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Further Environmental Mitigation and Residual Effect

11.8.6.22 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.8.7 POTENTIAL EFFECTS ON BENTHIC HABITATS THROUGH FISHING RESTRICTIONS

11.8.7.1 During the construction phase of the Offshore Project, temporary safety zones will be implemented that will prevent fishing activity from taking place within the vicinity of works. This could potentially result in a beneficial impact upon Benthic and Intertidal Ecology. Preventing the removal of shellfish species, and the subsequent reduction in impacts to benthic habitats from the displacement of potting (static gear), and mobile bottom fishing activity, reduces the potential for damage to sensitive/fragile species through seabed abrasion.

11.8.7.2 The construction phase of the Offshore Project is for a period of 5 years between 2028/2029 and 2032/2033. During this time the following safety zones will be implemented:

- 500 m safety zones around wind farm structure or offshore transmission infrastructure (WTG or OSP) and/or foundations during construction activities;
- 50 m safety zones around partially complete structures or complete structures;
- 500 m radius advisory safe passing distance around Offshore Project vessels undertaking cable installation;
- Safety zones and/or advisory safe passing distances in place throughout construction phase.

11.8.7.3 These safety zones will provide periods where species and habitats will not be pressured by fishing activity. The maximum design scenario relating to potential effects on benthic habitats through fishing restrictions during the construction phase is presented in **Table 11-14**.

Magnitude

11.8.7.4 The magnitude of impact is based on the criteria detailed in Section 11.5 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-22**.

11.8.7.5 The fishing activities that occur within the Offshore Project Boundary are detailed in **Chapter 21, Volume 2a**. The main fishing activity that is undertaken within the Offshore Project Boundary is potting, with some limited otter trawls restricted to the northeastern extent of the Array Area.

11.8.7.6 Temporary safety zones will be in place during the construction phase within the 161 km^2 Array Area. The construction activities would not occur across the entirety of the Turbine Area or OCAS at any one time. Temporary fishing restrictions will apply only within areas of active construction works. Fishing activity will not be prohibited in areas where construction has not yet commenced or is completed. This will provide a measure of protection to Benthic and Intertidal Ecology receptors over an over a wide spatial extent, albeit for a relatively short duration.

11.8.7.7 Temporary safety zones are likely to be in place for the duration of the construction activities, which are scheduled to take place over a maximum period of 5 years. However, they will move location as elements of the Offshore Project are developed and subsequently completed. Following cessation of construction activities, fishing activity will recommence within the Offshore Project Boundary. Before any commissioning activities, a safety zone with a radius of 50 m will be established around each constructed WTG or OSP (if required), and their associated foundation structures.

11.8.7.8 The duration and combined extent of the temporary safety zones indicates that the impacts from fishing restrictions during the construction phase will be of a medium term, reversible, beneficial, and of **Negligible** to **Low** magnitude. This is because changes to baseline conditions are considered within the range of natural variability to composition or character of a habitat/community, or population of a species is expected, with recovery expected within less than 5 years. The range of magnitude of impact reflects the range of habitat disturbance expected during the construction phase.

Sensitivity or value of receptor

High value habitats

11.8.7.9 The following habitats have been assigned a high ecological value, based upon criteria determined in Section 11.5.2 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project. For high-value habitats, the sensitivity to abrasion from potting activity has been used for impact assessment purposes, as the species that constitute these habitats are not commercially exploited. The sensitivity described for each receptors is based on the criteria provided in **Table 11-11**.

Annex I bedrock/stoney reef

11.8.7.10 Annex I bedrock/stoney reef has been assessed by MarLIN as having a low sensitivity to habitat disturbance in the form of abrasion/disturbance of the seabed (through fishing activity) (Stamp *et al.,* 2023a, Tillin *et al.,* 2023). The sensitivity has been derived from physical removal studies, which identified fragile species (urchins) as more susceptible to damage, whereas encrusting species (coraline algae and seaweeds) are able to tolerate disturbance and recolonise following cessation of activities. Therefore, the sensitivity to this impact is classed as **Low**.

Kelp beds

11.8.7.11 Kelp beds have been assessed by MarLIN as having a medium sensitivity to habitat disturbance in the form of abrasion/disturbance of the seabed from fishing gear (Stamp *et al.,* 2023b). This sensitivity is derived from a low tolerance and medium recoverability. Kelp has been observed to recolonise areas within 2-4 years following removal, however the epifaunal community it supports does not always return in this time. Therefore, the sensitivity to this impact is considered to be **Medium**.

Tide-swept algal communities

11.8.7.12 Tide-swept algal communities are considered by the FeAST tool to have a low sensitivity to habitat disturbance in the form of seabed abrasion (potting activity), due to the ability of the species present to recover rapidly, as long as the holdfasts remain (medium tolerance, high recoverability) (FeAST, 2025b). More severe damage including the loss of algal holdfasts may increase the sensitivity of this habitat to abrasion. Therefore, the sensitivity to this impact is considered to be **Low**.

Offshore subtidal sands and gravels

11.8.7.13 Offshore subtidal sands and gravels are considered by the FeAST tool to have a sensitivity ranging from negligible - high to disturbance in the form of seabed abrasion (potting activity), which is dependent upon the species present (FeAST, 2023)[11]. The higher sensitivities are based upon the presence of more fragile sessile species that are not able to tolerate any abrasion damage. Based upon the species present within the Offshore Project Boundary, the sensitivity to this impact is considered to be **Medium**.

***Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment**

11.8.7.14 A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment have been assessed by MarLIN as having a medium sensitivity to habitat disturbance in the form of seabed abrasion (potting activity) (De-Bastos *et al*., 2023). This sensitivity is derived from a low tolerance, but medium recoverability based upon brittle star species (which form the bulk of this habitat) being able to recover from some mechanical damage, however other more fragile species such as *Asterias rubens, Urticina felina,* and *Alcyonium digitatum* found within this biotope are not able to recover as easily as brittlestar. Therefore, the sensitivity to this impact is considered to be **Medium**.

Low value habitats

11.8.7.15 The following habitats have been assigned a low ecological value, based upon criteria determined in Section 11.5.2 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project. For low-value habitats, the sensitivity to abrasion has been used for impact assessment purposes, as the species that constitute these habitats are not commercially exploited. The sensitivity described for each receptor is based on the criteria provided in **Table 11-11**.

Circalittoral mixed sediments

11.8.7.16 A5.44 Circalittoral mixed sediments (continental shelf mixed sediments) are considered by the FeAST tool to have a medium sensitivity to disturbance in the form of seabed abrasion (potting activity), which is dependent upon the species present, with more fragile, sessile species having a lower tolerance than more robust mobile ones (FeAST 2023)[12]. Therefore, the sensitivity to this impact is considered to be **Medium**.

***Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment**

11.8.7.17 A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment has been assessed by MarLIN as having a medium sensitivity to abrasion/disturbance of the seabed (Readman and Watson, 2024). This sensitivity has been derived from a low tolerance and medium recoverability. Abrasion from fishing gear has been shown to damage emergent macrofauna such as hydroids, with increasing activity resulting in larger impacts to habitats and species. The sessile nature of the species associated with this type of habitat also reduces their ability to tolerate repeated damage. Therefore, the sensitivity to this impact is considered to be **Medium**.

Shellfish species

11.8.7.18 The following shellfish species have been assigned a medium ecological value, based upon criteria determined in Section 11.5.2 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the construction phase of the Offshore Project. The sensitivity of shellfish species to removal of target species, has been used within the impact assessment as they are actively removed by fisheries. Additional impacts from cessation of seabed activities such as abrasion from potting, can also have impacts through removal of abrasion impacts, therefore this has also been considered when determining sensitivity.

Decapod crustaceans

11.8.7.19 Norway lobster and brown crab as proxies for the 4 decapod crustaceans (Norway lobster, brown crab, pink shrimp and squat lobster).

11.8.7.20 Norway lobster have been assessed by MarLIN as having have a low sensitivity to sustainable fishing pressure, although this increases to a medium sensitivity, if 50% of the population is removed (Hill and Sabatini, 2008). The sensitivity is derived from a medium tolerance and high recoverability. Due to prevailing currents, the species retain their ability to recruit strongly from larvae to the adult population. Brown crab have been assessed by MarLIN as having has a low sensitivity to sustainable fishing pressure, although this increases to a medium sensitivity if 50% of the population is removed (Neal and Wilson, 2008). The low sensitivity is based upon the fact that berried females do not feed and therefore are rarely caught in baited pots, thus allowing the species to recover if fishing pressure is reduced. Norway lobster has been assessed by MarLIN as having a low sensitivity to seabed abrasion (from activities such as bottom trawling and potting). This sensitivity is based upon a medium tolerance to disturbance and high recoverability as this species is able to re-establish burrows within 2 days of disturbance if individuals are not damaged (Hill and Sabatini, 2008). Brown crab have been assessed by MarLIN as having a low sensitivity to seabed abrasion (from activities such as bottom trawling and potting). This sensitivity is derived from a medium tolerance to abrasion due to the brittleness of their shells and a high recoverability due to reproductive strategy (Neal and Wilson, 2008). Therefore, the sensitivity of decapod crustaceans to fishing activity is considered to be **Low**.

Common whelk

11.8.7.21 Common whelk is a commercially exploited bivalve species, resident around the whole of the UK coastline (Ager, 2008). Common whelk fisheries are often over exploited due to a combination of their reproductive strategy (low fecundity and age of first sexual maturity), and the level of exploitation (Valentinsson, 2002); equating to medium tolerance and recoverability. Therefore, the sensitivity of common whelk to fishing activity is considered to be **Medium**.

Bivalve molluscs

11.8.7.22 There are 3 commercial species of bivalve, razor clam, king scallop and dog cockle that have been recorded within the Survey Area, with the sensitivity of razor clams being used to determine the sensitivity of bivalves. Razor clams have been assessed by MarLIN as having have a low sensitivity to sustainable fishing pressure, although this increases to a medium sensitivity if 50% of the population is removed (Hill, 2024). This sensitivity is due to this species ability to recover populations within 5 years following cessation of fishing pressure. Razor clam has been assessed by MarLIN as having a medium sensitivity to seabed abrasion (from activities such as potting). This sensitivity is derived from a low tolerance to seabed abrasion due to the brittleness of their shells, which can result in mortality and a high recoverability due to recruitment potential (Hill, 2024). Recruitment within razor clam can be sporadic, therefore potential impacts from mortality events have the potential to take up to 5 years to for recovery to occur (Hill, 2024). Therefore, the sensitivity of bivalve molluscs to seabed abrasion is considered to be **Medium**, making the overall sensitivity to bivalve molluscs to fishing activity considered to be **Medium**.

Edible sea urchin

11.8.7.23 Edible sea urchin have been assessed by MarLIN as having has a low sensitivity to sustainable fishing pressure, although this increases to a medium sensitivity if 50% of the population is removed (Tyler-Walters, 2008). The low sensitivity is based upon that the harvesting practice for this species, which is typically hand removal by divers, and they tend to collect the largest individuals they see and avoid the smaller specimens which are often hidden within the environment, i.e. under kelp fronds and under rocks. Edible sea urchin has been assessed by MarLIN as having a low sensitivity to seabed abrasion (from activities such as potting). This sensitivity is derived from a medium tolerance to disturbance due to the brittleness of their tests, which can result in mortality, but a high recoverability due to the high fecundity of this species and ability to recover numbers rapidly (Tyler-Walters 2008). Therefore, the overall sensitivity of sea urchin to impacts from fishing activity is considered to be **Low**.

Cuttlefish

11.8.7.24 Cuttlefish have been assessed by MarLIN as having a medium sensitivity to sustainable fishing pressure (Gibson-Hall and Wilson, 2018). This sensitivity is derived from a low tolerance and medium recoverability. This is based upon the species ability to maintain existing population levels based upon the current fishing pressure, although increases in exploitation may reduce this species ability to recover. Cuttlefish have been assessed by MarLIN as having a medium sensitivity to physical disturbance from activities such as seabed abrasion (Gibson-Hall and Wilson, 2018). This sensitivity is derived from the mobility of this species and although adults are able to avoid areas of habitat disturbance, they have soft bodies which are susceptible to damage. Furthermore, if disturbance occurs following the laying of eggs, this could impact the population by the removal of future cohorts resulting in a medium tolerance. This species, however, has a medium ability to recover due to their high fecundity and therefore it is able to replace losses if successful recruitment events occur. Therefore, the overall sensitivity of cuttlefish to impacts from fishing activity is considered to be **Medium**.

Significance of effect

11.8.7.25 Safety zones which impose fishing restrictions within the Offshore Project Boundary have the potential to result in beneficial effects to Benthic and Intertidal receptors, through displacement of activities such as potting for the duration of the construction phase of the Offshore Project and reducing the removal of shellfish species. It should be noted that displacement of fishing activity is an indirect effect, borne out of the necessity to ensure construction activities are not disturbed by fishing vessels or deployed fishing gear (through the implementation of safety zones), therefore there are no specific project mitigation measures to consider when assessing this impact. The potential effects on benthic habitats through fishing restrictions on Benthic and Intertidal Ecology receptors are detailed in **Table 11-22**.

Table 11-22: Significance of effect of fishing restrictions to benthic and intertidal ecology receptors during the construction phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Low	N/A	**Negligible**	Not significant	N/A
Kelp beds	Low	High	Medium	N/A	Short-term, direct, reversible, **Minor beneficial**	Not significant	N/A
Tide-swept algal communities	Low	High	Low	N/A	**Negligible**	Not significant	N/A
Offshore subtidal sands and gravels	Low	High	Medium	N/A	**Negligible**	Not significant	N/A
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Medium	N/A	Short-term, direct, reversible, **Minor beneficial**	Not significant	N/A
Circalittoral mixed sediments	Low	Low	Medium	N/A	Short-term, direct, reversible, **Minor beneficial**	Not significant	N/A
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Medium	N/A	Short-term, direct, reversible, **Minor beneficial**	Not significant	N/A
Decapod crustaceans	Low	Medium	Low	N/A	**Negligible**	Not significant	N/A
Common whelk	Low	Medium	Medium	N/A	Short-term, direct, reversible, **Minor beneficial**	Not significant	N/A
Bivalve molluscs	Low	Medium	Medium	N/A	Short-term, direct, reversible, **Minor beneficial**	Not significant	N/A

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Edible sea urchin	Low	Medium	Low	N/A	**Negligible**	Not significant	N/A
Cuttlefish	Low	Medium	Medium	N/A	Short-term, direct, reversible, **Minor beneficial**	Not significant	N/A

Further environmental mitigation and residual effects

11.8.7.26 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.9 ASSESSMENT OF EFFECTS: OPERATION AND MAINTENANCE

11.9.1 LONG-TERM LOSS OF HABITAT

11.9.1.1 The presence of Offshore Project infrastructure (WTG foundations and associated scour protection, Array Cables and associated cable protection and stabilisation) will lead to long-term subtidal habitat loss over an O&M duration of up to 35 years. Habitat loss associated with the lifespan of the cable protection if permanently left in-situ is also considered, based on the maximum design scenario that scour and cable protection may be left in situ (see Section 11.10.1). Under this scenario, long-term habitat loss would be continuous across all project phases (construction, O&M and decommissioning). These are therefore considered in aggregate as a single long-term impact pathway.

11.9.1.2 The maximum design scenario relating to long-term habitat loss during the O&M phase is presented in **Table 11-14**.

Magnitude

11.9.1.3 The magnitude of impact is based on the criteria detailed in Section 11.5 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-25**.

11.9.1.4 Permanent seabed habitat loss of up to 2,411,500 m^2 (2.41 km^2) will occur from the installation of infrastructure within the Offshore Project Boundary (see **Table 11-14**). This total comprises approximately, 661,500 m^2 (0.66 km^2) of long-term habitat loss from 60 WTGs and associated scour protection; up to 1,750,000 m^2 (1.75 km^2) from cable stabilisation along 350 km of Array Cables to Final WTGs and Array Cables to landfall; and 4,875 m^2 (0.0049 km^2) from the 13 HDD Exit Pits within the Landfall Exit Pit Area (see **Table 11-14**).

11.9.1.5 Based on the proposed infrastructure footprint area described above, long term habitat loss areas were estimated for each habitat and for Annex I reef classification identified from Subtidal Environmental Baseline Survey, **Appendix 11.1, Volume 2c** habitat mapping. For offshore cable footprint areas within the Array Area and OCAS, where cable routes are yet to be defined, habitat loss was based on the percentage area in which a habitat was identified within the Offshore Project Boundary applied then to the area of footprint associated with the cable. For all other infrastructure including WTG foundations and scour protection, footprint areas were based on indicative array grid layouts. HDD Exit pits were located within the habitat A3.21 (Annex I bedrock reef) to reflect a worst case in terms of sensitivity with respect to this.

11.9.1.6 **Table 11-23** presents the predicted percentage of habitat that will result in long term loss within the Offshore Project boundary. The percentages calculated indicate that for all identified habitats, the percentage of habitat loss as a consequence of the infrastructure footprint is <0.3% except for habitat A4.21 *Echinoderms and crustose communities on circalittoral rock* (Annex I Bedrock and/or Stony Reef) which is 1.12%.

11.9.1.7 **Table 11-24** presents the percentage of Annex I reef that will result in long term loss within the Offshore Project boundary. The percentages calculated indicate that for all identified Annex I reef types, a total lost 1.15% for Annex I reef identified within Offshore Project boundary will be impacted, with medium stony reef reflecting the most abundant Annex I reef type.

Table 11-23: Predicted percentage habitat loss from the Offshore Project.

EUNIS Code	EUNIS Description	Predicted total % loss of habitat from Infrastructure within Offshore Project Boundary
Annex I Bedrock and/or Stony Reef		
A3.11	Kelp with cushion fauna and/or foliose red seaweeds	**0.02**
A3.21	Kelp and red seaweeds (moderate energy infralittoral rock)	**0.29**
A4.21	Echinoderms and crustose communities on circalittoral rock	**1.12**
A4.214	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	**0.01**
Offshore subtidal sands and gravels		
A5.14	Circalittoral coarse sediment	**0.02**
A5.26	Circalittoral muddy sand	**0.10**

Table 11-24: Predicted percentage Annex I reef habitat loss from the Offshore Project.

Annex I Reef Type	Total % loss from Infrastructure within Offshore Project Boundary
Bedrock	**0.01**
High Stony	**0.0002**
Low Stony	**0.0041**
Medium Stony	**1.14**

11.9.1.8 The majority of habitats affected by the project footprint, the change would represent a shift from natural hard substrate to artificial hard substrate (e.g. concrete or rock scour protection), rather than complete removal. In contrast, limited and localised pockets of A5.14 Circalittoral coarse sediment and A3.21 *Laminaria digitata* on moderately exposed sublittoral fringe rock in the nearshore portions of the OCAS will be subject to long-term habitat loss and replaced with non-natural substrates (such as cable protection), resulting in the loss of those soft sediment or mixed habitat features.

11.9.1.9 The areas subject to permanent change will occur over a wide spatial extent, however the changes will be discrete and highly localised, either in the immediate vicinity of WTG foundations (including scour protection) or along narrow, linear stretches of the cable route. While the change from natural to artificial substrate does not constitute complete functional loss, it alters physical structure and ecological character, which may affect associated benthic communities. It should be noted that there is some potential for recolonisation on artificial hard structures by epifaunal species. As such, considering the adverse nature of the impact, its limited spatial extent (i.e. within the Array Area and OCAS), partial reversibility, intermittent frequency, and long-term duration, the overall magnitude of impact is assessed as **Negligible** to **Low**. This is because changes to baseline conditions are considered within the range of natural variability and due to partial loss and/or recoverable alteration to the extent (as exemplified by the predicted losses of <1.15 % for Annex I Reef and <0.12% for offshore subtidal sands and gravels), composition or character or a habitat/community, or population of a species, with recovery expected within less than 5 years, following the completion of construction activities. The range of magnitude of impact reflects the range of potential habitat loss expected during the operational phase.

Sensitivity or value of receptor

High value habitats

11.9.1.10 The following habitats have been assigned a high ecological value, based upon criteria determined in Section 11.5.3. This has been considered when determining the overall sensitivity of the habitats to impacts from the O&M phase of the Offshore Project.

Annex I bedrock/stoney ***reef***

11.9.1.11 Annex I bedrock/stoney reef has been assessed by MarLIN as having a high sensitivity in changes in seabed type, although it should be noted that this is from hard substrates to soft sediments (Stamp *et al.,* 2023a, Tillin *et al.,* 2023). This sensitivity is based upon the fact that this habitat is only found on hard substrates. It should be noted that the Offshore Project will not be introducing any permanent areas of soft substrate, therefore tolerance and recoverability is likely to be higher, and the sensitivity to this impact is likely to be lower. Based upon this, a precautionary sensitivity of **Medium** will be used for this habitat type.

Kelp beds

11.9.1.12 Kelp beds (notably those formed by *Laminaria hyperborea* and other canopy kelps) are assessed by MarLIN (e.g. Stamp *et al.*, 2023b) as having high sensitivity to habitat loss, particularly when hard substrate is replaced by soft sediment. This is because kelp forests require stable rocky substrata for holdfast attachment, strong water movement or wave exposure, and sufficient light penetration; a change in substrate type or sediment deposition regime undermines essential life-functions including attachment, growth, reproduction, and canopy formation. In Scotland/*Alba*, kelp beds are designated PMFs under NatureScot; the Scottish Government places high policy weight on their protection both for biodiversity and for ecosystem services such as carbon sequestration, coastal protection, nursery habitats for commercial species, and nutrient cycling (NatureScot, 2024; Heriot-Watt modelling 2025). Recent studies underscore that sediment loading, soft sediment encroachment, or burial reduce light availability, physically smother juvenile sporophytes, reduce recruitment, and destabilise holdfasts (Farrugia-Drakard *et al*., 2023). In addition, hard substrate loss is not readily reversible: recovery of kelp forests after substrate loss can take many years or decades, given slow growth rates, limited dispersal of large blades, and dependency on substrate condition. Therefore, in habitats where foundations or cables might cause substrate alteration (e.g. hard replaced by soft, or smothering from sediment resuspension), kelp bed sensitivity to habitat loss is high, and best management requires avoiding such changes, or where unavoidable, ensuring restoration and monitoring to maintain ecological integrity.

11.9.1.13 The sensitivity of the habitat to this impact is considered to be **High**

Tide-swept algal communities

11.9.1.14 Tide-swept algal communities are considered by the FeAST tool to have a low sensitivity to long term habitat loss (FeAST, 2025b). This is due to the mixed substrata that this community is found on and its ability to colonise and recover (indicating a medium tolerance and high recoverability). The introduction of artificial hard substrate could provide additional habitat for this community to colonise. Therefore, the sensitivity to this impact is considered to be **Low**.

Offshore subtidal sands and gravels

11.9.1.15 Offshore subtidal sands and gravels are considered by the FeAST tool to have a medium sensitivity to slight changes in habitat type, but a high sensitivity in large changes in habitat type (from sand/gravel to rock protection) (FeAST, 2023)[11]; equating to a lower tolerance and recoverability. Therefore, the sensitivity to this impact is considered to be **High**.

***Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment**

11.9.1.16 A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment has been assessed by MarLIN as having a high sensitivity to long term habitat loss due to the habitat being reclassified if the substrate changed indicating no resistance and a low recoverability (De-Bastos *et al*., 2023). Therefore, the sensitivity to this impact is considered to be **high**.

Blue Carbon Receptors

11.9.1.17 The value of blue carbon receptors is considered to be high. The sensitivity of blue carbon receptors (kelp beds, and *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds) have been assessed as high in response to long term habitat loss. Therefore, the sensitivity of blue carbon receptors to habitat loss is considered to be **High**.

Low value habitats

11.9.1.18 The following habitats have been assigned a low ecological value, based upon criteria determined in Section 11.5.3. This has been considered when determining the overall sensitivity of the habitats to impacts from the O&M phase of the Offshore Project.

Circalittoral mixed sediments

11.9.1.19 A5.44 Circalittoral mixed sediments (continental shelf mixed sediments) are considered by the FeAST tool considers having a high sensitivity to changes in habitat type (FeAST 2023)[12]; equating to a lower tolerance and recoverability. Therefore, the sensitivity to this impact is considered to be **High**.

***Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment**

11.9.1.20 A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment has been assessed by MarLIN as having a high sensitivity to changes in sediment type from softer sediments such as sands to harder substrates such as rock and pebble (Readman and Watson, 2024). Changes to other substrate types such as soft sediments will alter the biological assemblage indicating a low tolerance and low ability to recover. Therefore, the sensitivity to this impact is considered to be **High**.

Shellfish species

11.9.1.21 The following shellfish species have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of these shellfish species to impacts from the O&M phase of the Offshore Project.

Decapod crustaceans

11.9.1.22 For decapod crustaceans, the sensitivity of Norway lobster and brown crab have been used to determine the sensitivity. Norway lobster have been assessed by MarLIN as having a medium sensitivity to habitat loss, as removal of suitable habitat may result in the removal of a resident population, and if suitable habitat has been lost, this species may struggle to recover indicating a low tolerance (Hill and Sabatini, 2008). In addition, Norway lobster take several years to reach maturity, therefore large-scale habitat loss has the potential to result in the reduced ability of this species to recover (indicating a medium recoverability). Brown crab have been assessed by MarLIN as having a medium sensitivity to habitat loss, as removal of suitable habitat may result in the removal of a resident population, however brown crab is able to recolonise areas of suitable habitat due to the mobile nature of adults and will readily recolonise following cessation of activities (Neal and Wilson, 2008). Therefore, the sensitivity to this impact is considered to be **Medium**.

Common whelk

11.9.1.23 Common whelk are recorded as present around the whole of the UK, inhabiting a wide variety of habitat types from muddy-sand, to gravels and rocky substrates and at a range of water depths from the intertidal zone, down to depths of 1,200 m (Ager, 2008). Based upon the widespread nature of this species and its ability to colonise a wide range of habitat types, it is likely to have a negligible sensitivity to habitat loss as it is able to function on rock as easily as other substrate types such as sand; exhibiting high tolerance. Therefore, the sensitivity to this impact is likely to be **Negligible**.

Bivalve molluscs

11.9.1.24 There are 3 commercial species of bivalve, razor clam, king scallop and dog cockle that have been recorded within the Study Area, with the sensitivity of razor clams being used to determine the sensitivity of bivalves. Razor clams have been assessed by MarLIN as having a medium sensitivity to habitat loss, as removal of suitable habitat may result in the removal of a resident population (indicating low tolerance), however razor clams have a high recoverability and are able to recover over a short period of time and recolonise areas of suitable habitat due to the mobile nature of adults and reproductive strategy including pelagic larvae (Hill, 2024). Therefore, the sensitivity to this impact is considered to be **Medium**.

Edible sea urchin

11.9.1.25 Edible sea urchin has been assessed by MarLIN as having a medium sensitivity to habitat loss This sensitivity is based upon a low tolerance as removal of suitable habitat may result in the removal of a resident population as it is a slow-moving species, however it has a high recoverability due to its reproductive strategy (Tyler-Walters, 2008). In addition, edible sea urchin is also able to switch food sources if the main source (kelp) is removed, thus lowering sensitivity. Therefore, the sensitivity to this impact is considered to be **Medium**.

Cuttlefish

11.9.1.26 Cuttlefish have been assessed by MarLIN as having a medium sensitivity to habitat loss, as different life stages have different habitat requirements (Gibson-Hall and Wilson, 2018). Sensitivity is derived from a medium tolerance and medium ability to recover from changes (due to fecundity of this species). Adult cuttlefish are more resilient to changes in habitat, however juveniles require areas of soft sediment in which to bury to avoid predation. If areas of suitable habitat for juveniles are removed, there is the risk of potential increases in predation. Therefore, the sensitivity to this impact is considered **Medium**.

Significance of effect

11.9.1.27 Long-term habitat loss is anticipated to take place during the O&M phase of the Offshore Project. Considering the embedded mitigation described in **Table 11-15,** the effects of long-term loss of habitat on Benthic and Intertidal Ecology receptors are detailed in **Table 11-25**.

Table 11-25: Significance of effect of long-term habitat loss to benthic ecology receptors during the O&M phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stoney reef	Low	High	Medium	M001, M002, M025	Short-term, direct, non-reversible, **Minor adverse**	Not significant	Habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. Species recorded within this habitat are adapted to living on bedrock and other hard substrate. The predicted total loss of habitat within the Offshore Project Boundary is approximately 1.44% and is provided within **Table 11-23**.
Kelp beds	Low	High	High	M001, M002, M025	Short-term, direct, non-reversible, **Minor adverse**	Not significant	The Landfall Exit Pit Area is located approximately 500-1,500 m offshore, in water depths of 15-25 m mean sea level, thereby avoiding disturbance of the intertidal zone entirely. The predicted total loss of habitat within the Offshore Project Boundary is less than 1% and is provided within **Table 11-23**. Kelp beds are present along the coastline of Scotland/*Alba* and are not restricted to the Offshore Project Boundary.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Tide-swept algal communities	Low	High	Low	M001, M002, M025	**Negligible**	Not significant	Mainly located in the intertidal zone. The use of HDD beneath the intertidal zone will limit the magnitude of impact. The predicted total loss of habitat within the Offshore Project Boundary is less than 1% is and is provided within **Table 11-23.**
Offshore subtidal sands and gravels	Negligible	High	High	M001, M002, M025	**Negligible**	Not significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of the UK coastline and not restricted to the Offshore Project Boundary. The predicted total loss of habitat within the Offshore Project Boundary is approximately 0.12% and is provided within **Table 11-23.**
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	High	M001, M002, M025	Long-term-, direct, non-reversible, **Minor adverse**	Not significant	The species that constitute this habitat are found on hard substrates and will be able to colonise areas of artificial substrate/rock protection.
Circalittoral mixed sediments	Low	Low	High	M001, M002, M025	Long-term-, direct, non-reversible, **Minor adverse**	Not significant	Habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. The predicted total loss of habitat within the Offshore Project

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							Boundary is less than 1% is and is provided within **Table 11-23.**
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	High	M001, M002, M025	Long-term-, direct, non-reversible, **Minor adverse**	Not significant	The species that constitute this habitat are found on hard substrates and will be able to colonise areas of artificial substrate/rock protection. The predicted total loss of habitat within the Offshore Project Boundary is less than 1% is and is provided within **Table 11-23**.
Decapod crustaceans	Low	Medium	Low	M001, M002, M025	Long-term-, direct, non-reversible, **Minor adverse**	Not significant	The decapod crustaceans that are recorded within the Offshore Project Boundary are adapted to a range of substrate types, with only Norway Lobster requiring sand substrates for creating burrows. The others are adapting to living across a range of substrate types including coarse sediments and larger rock areas. The rock protection used for scour protection has the potential to provide habitat for lobster and crab species.
Common whelk	Low	Medium	Negligible	M001, M002, M025	**Negligible**	Not significant	Common whelk are able to adapt to and colonise a wide range of habitat types, therefore habitat change to

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							another type is unlikely to cause significant impacts.
Bivalve molluscs	Low	Medium	Medium	M001, M002, M025	Long-term-, direct, non-reversible, **Minor adverse**	Not significant	The bivalve mollusc species recorded within the Offshore Project Boundary are adapted to sand substrate, avoidance of these areas will reduce the impacts to these species.
Edible sea urchin	Low	Medium	Medium	M001, M002, M025	Long-term-, direct, non-reversible, **Minor adverse**	Not significant	Edible sea urchin is able to colonise a wide variety of substrate types and will be able to adapt to the inclusion of rock protection and scour protection.
Cuttlefish	Low	Medium	Medium	M001, M002, M025	Long-term-, direct, non-reversible, **Minor adverse**	Not significant	Cuttlefish are recorded over a wide range of seabed types, with soft substrates required for juvenile life history stages to avoid predators. Adults will often forage over rocky areas due to the presence of prey species.
Blue carbon receptors (kelp beds, brittlestar beds).	Low	High	High	M001, M002, M025	Long-term-, direct, non-reversible, **Minor adverse**	Not significant	See commentary above for 'kelp beds' and 'brittlestar beds'.

Further Environmental Mitigation and Residual Effect

11.9.1.28 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in **Table 11-15**) is not significant in EIA terms.

11.9.2 LONG-TERM HABITAT DISTURBANCE

11.9.2.1 Maintenance activities such as repairs to piling footings, scour protection, checking and repair of cables has the potential to result in long term habitat disturbance across the lifetime of the Offshore Project. This could take the form of seabed abrasion from the movement of rock protection, seabed abrasion from moving and relaying cable and the replacement of armour following repairs. The maximum design scenario relating to long-term habitat disturbance during the operation and maintenance phase are presented in **Table 11-14**.

Magnitude

11.9.2.2 The magnitude of impact is based on the criteria detailed in Section 11.5 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-26**.

11.9.2.3 Temporary seabed disturbance will occur during the O&M phase. This may result from episodic activities such as cable repair, reburial, or replacement, and the use of jack-up vessels for turbine component replacement. Under the maximum design scenario (see **Table 11-14**), 1,750,000 m^2 (1.75 km^2) of seabed disturbance may occur for each full cable replacement, with cable replacement occurring up 9 times across the Offshore Project lifetime and therefore producing a total area of disturbance of 15,750,000 m^2 (15.75 km^2). Jack-up barge deployment for major (3 times per WTG) and minor component (10 times per WTG) replacements for WTG's over the Offshore Project lifetime and therefore producing a total area of disturbance of 11,860,800 m^2 (11.860 km^2). Maintenance activities will equate up to 27,610,800 m^2 (27.61 km^2) of temporary habitat disturbance. While these activities are short in duration and reversible, they represent repeated disturbance events across operational lifespan of up to 35 years. Associated cable reburial is expected to be undertaken using the same methods as those used during installation, with jet trenching representing the worst-case scenario in terms of temporary disturbance.

11.9.2.4 Any temporary habitat disturbance during O&M are expected to be of the same or lower magnitude than those assessed for the construction phase. It is acknowledged that repair and replacement of Array Cables up to 9 times; and the reburial/protection replacement of exposed Array Cable sections up to 6 times, could occur on multiple occasions over the Offshore Project's operational life which may result in a greater frequency of localised habitat disturbance events compared to the construction phase. However, it should be noted that the scale of works will be reduced as each event will occur over a smaller spatial and temporal scale than the initial construction phase. As such, the magnitude of impact is assessed as being **Negligible** to **Low**. This is because changes to baseline conditions are considered within the range of natural variability and due to partial loss and/or recoverable alteration to the extent, composition or character of a habitat/community, or population of a species, with recovery expected within less than 5 years. The range of magnitude of impact reflects the range of habitat disturbance expected during the operational phase. Although maintenance activities generating temporary habitat disturbance will be for short durations for each event, they will occur over Offshore Project's lifetime of up to 35 years, therefore will result in a long-term impact to Benthic and Intertidal Ecology receptors.

Sensitivity or value of receptor

11.9.2.5 The high value habitats of annex I bedrock/stoney reef, kelp beds, tide-swept algal communities, offshore subtidal sands and gravels, *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment have been assigned a high ecological value, based upon criteria determined in Section 11.8.2 of this chapter. The sensitivities of these habitats to long term habitat disturbance during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.1, which are based on criteria provided in **Table 11-11**.

11.9.2.6 The low value habitats of Circalittoral mixed sediments and *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment have been assigned a low ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these habitats to long term habitat disturbance during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.1.

11.9.2.7 Regarding shellfish species, the 4 decapod species, common whelk, the 3 bivalve mollusc species, edible sea urchin and cuttlefish have been assigned a medium ecological value, based upon criteria determined in Section 11.5.2 of this chapter. The sensitivities of these species to long term habitat disturbance during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.1.

Significance of effect

11.9.2.8 Long-term *habitat* disturbance is anticipated to take place during the O&M phase of the Offshore Project. Considering the embedded mitigation described in **Table 11-15**, residual effects of long-term habitat disturbance on Benthic and Intertidal Ecology receptors are detailed in **Table 11-26**.

Table 11-26: Significance of effect of long-term habitat disturbance to benthic and intertidal ecology receptors during the O&M phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Low	M001, M002, M025	**Negligible**	Not significant	Habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. Species recorded within this habitat are adapted to living on bedrock and other hard substrate. The area of habitat affected by is small and disturbance is considered reversible with recovery expected within 5 years.
Kelp beds	Negligible	High	Medium	M001, M002, M025	**Negligible**	Not significant	HDD beneath the intertidal zone will ensure the majority of kelp beds within the Offshore Project Boundary are avoided. Kelp beds are present along the coastline of Scotland/*Alba* and are not restricted to the Offshore Project Boundary. As a result, changes to baseline conditions are considered within the range of natural variability.
Tide-swept algal communities	Low	High	Low	M001, M002, M025	**Negligible**	Not significant	Mainly located in the intertidal zone. The use of HDD beneath the intertidal zone will limit the magnitude of impact. The area of habitat affected by is small and disturbance is

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							considered reversible with recovery expected within 5 years.
Offshore subtidal sands and gravels	Negligible	High	Medium	M001, M002, M025	**Negligible**	Not significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of the UK coastline and not restricted to the Offshore Project Boundary. Changes to baseline conditions are considered within the range of natural variability.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Medium	M001, M002, M025	Long-term, direct, reversible, **Minor adverse**	Not significant	The area of habitat affected by is small and disturbance is considered reversible with recovery expected within 5 years.
Circalittoral mixed sediments	Negligible	Low	Medium	M001, M002, M025	**Negligible**	Not significant	This habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. Changes to baseline conditions are considered within the range of natural variability.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Medium	M001, M002, M025	Long-term, direct, **Minor adverse**	Not significant	The area of habitat affected by is small and disturbance is considered reversible with recovery expected within 5 years.

Receptor	**Magnitude**	**Value**	**Sensitivity**	**Embedded mitigation measures**	**Significance of effect**	**Significance**	**Commentary**
Decapod crustaceans	Low	Medium	Low	M001, M002, M025	**Negligible**	Not significant	Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Common whelk	Low	Medium	Medium	M001, M002, M025	Long-term, direct, **Minor adverse**	Not significant	Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Bivalve molluscs	Low	Medium	Medium	M001, M002, M025	Long-term, direct, **Minor adverse**	Not significant	Bivalve species identified within the Offshore Project Boundary require areas of soft sediment. Avoidance of these areas (where practicable) will further reduce the potential for adverse impacts. Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Edible sea urchin	Low	Medium	Low	M001, M002, M025	**Negligible**	Not significant	Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Cuttlefish	Low	Medium	Medium	M001, M002, M025	Long-term, direct, **Minor adverse**	Not significant	Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.

Further Environmental Mitigation and Residual Effect

11.9.2.9 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.9.3 TEMPORARY SEABED HABITAT LOSS AND/OR DISTURBANCE

11.9.3.1 Temporary habitat loss and/or disturbance may occur intermittently and be repeated during O&M activities, including repair or replacement of cable sections and major component replacement of WTGs requiring a jack-up vessel. The maximum design scenario relating to temporary habitat loss and/or disturbance during the O&M phase are presented in **Table 11-14**.

11.9.3.2 Habitat disturbance will include localised effects on the seabed associated with cable repair works, such as exposure or re-burial of cables and mechanical abrasion caused by cable handling. The deployment of jack-up vessel legs during major component replacement may also disturb the substrate and compress sediments within the immediate footprint of the stabilising legs, resulting in temporary alteration of habitat characteristics.

11.9.3.3 Temporary habitat disturbance may change, disturb or alter habitats, which subsequently affects the associated benthic community. Temporary reduction in habitat suitability or resource availability could also result in displacement of fauna into adjacent areas of varying suitability. This is more likely to affect sessile species with limited mobility compared to mobile species that can move away from potentially impacted areas.

Magnitude

11.9.3.4 The magnitude of impact is based on the criteria detailed in Section 11.5.3.6 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-27.**

11.9.3.5 Temporary habitat loss and/or disturbance will affect only a small proportion of available habitat relative to the wider marine area. Short term disturbances during O&M are considered adverse, occurring over the operational lifespan of the Offshore Project, but intermittent, and each incidence is considered short in duration. Short term disturbance is considered to be highly localised and reversible through natural recovery processes. Based on the ground disturbance activities outlined in the maximum design scenario detailed in **Table 11-14** seabed disturbance may occur, as a result of repair and replacement of Offshore Cables (up to 15,750,000 m^2 (15.750 km^2) and replacement of major and minor WTG components (up to 11,860,800 m^2 (11.860 km^2). Maintenance activities will equate up to 27,610,800 m^2 (27.610 km^2) of temporary habitat disturbance representing approximately 13.27% of the Offshore Project Boundary. While these activities are short in duration and reversible, they represent repeated disturbance events across the 35-year operational lifespan.

11.9.3.6 Embedded Offshore Project mitigation measures are detailed within **Table 11-15** and include micro-siting, selection of least-impact methods for repair (M001, M002), best practice seabed excavation (M005) and management of O&M activities (M025, M054) to reduce disturbance extent and duration. Considering the limited spatial extent, short duration, intermittent timing, and high natural variability of benthic habitats within the O&M footprint, the overall magnitude of temporary habitat disturbance is assessed as **Negligible** to **Low**. This is because impacts fall within natural variability or constitute partial, recoverable alteration to habitats or communities, with recovery expected within fewer than 5 years.

Sensitivity or value of receptor

11.9.3.7 The high value habitats of annex I bedrock/stoney reef, kelp beds, tide-swept algal communities, offshore subtidal sands and gravels, *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment and blue carbon receptors have been assigned a high ecological value, based upon criteria determined in **Table 11-12** of this chapter. The sensitivities of these habitats to temporary seabed habitat loss and/or disturbance during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.1, which are based on criteria provided in **Table 11-11**.

11.9.3.8 The low value habitats of Circalittoral mixed sediments and *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment have been assigned a low ecological value, based upon criteria determined in **Table 11-12** of this chapter. The sensitivities of these habitats to temporary seabed habitat loss and/or disturbance during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.1.

11.9.3.9 Regarding shellfish species, the 4 decapod species, common whelk, the 3 bivalve mollusc species, edible sea urchin and cuttlefish have been assigned a medium ecological value, based upon criteria determined in **Table 11-12** of this chapter. The sensitivities of these species to temporary seabed habitat loss and/or disturbance during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.1.

Significance of effect

11.9.3.10 Temporary habitat loss and/or disturbance is anticipated to take place during the O&M phase of the Offshore Project. Considering the embedded mitigation described in **Table 11-15,** the effects of temporary habitat disturbance on Benthic and Intertidal Ecology receptors are summarised in **Table 11-28**.

Table 11-27 Significance of effect of temporary habitat loss and/or disturbance to Benthic Ecology receptors during the Operation and Maintenance phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I Bedrock and/or Stony Reef	Low	High	Low	M001, M002, M005, M025, M054	**Negligible**	Not significant	Habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. Species recorded within this habitat are adapted to living on bedrock and other hard substrate. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Kelp beds	Low	High	Medium	M001, M002, M005, M025, M054	Short-term, direct, reversible, **Minor adverse**	Not significant	HDD beneath the intertidal zone will ensure the majority of kelp beds within the Offshore Project Boundary are avoided. Kelp beds are present along the coastline of Scotland/*Alba* and are not restricted to the Offshore Project Boundary. The area of habitat affected by

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							is small and disturbance is considered reversible with recovery expected within 5 years.
Tide-swept algal communities	Low	High	Low	M001, M002, M005, M025, M054	**Negligible**	Not Significant	Mainly located in the intertidal zone. The use of HDD beneath the intertidal zone will limit the magnitude of impact. The area of habitat affected by is small and disturbance is considered reversible with recovery expected within 5 years.
Offshore subtidal sands and gravels	Negligible	High	Medium	M001, M002, M005, M025, M054	**Negligible**	Not Significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of the UK coastline and not restricted to the Offshore Project Boundary. Changes to baseline conditions are considered within the range of natural variability.
Ophiothrix fragilis and/or *Ophiocomina*	Low	High	Medium	M001, M002, M005,	Short-term, direct, reversible, **Minor adverse**	Not Significant	The area of habitat affected by is small and disturbance is considered reversible with

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
nigra brittlestar beds				M025, M054			recovery expected within 5 years.
Circalittoral mixed sediments	Negligible	Low	Medium	M001, M002, M005, M025, M054	**Negligible**	Not Significant	This habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. Changes to baseline conditions are considered within the range of natural variability.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Medium	M001, M002, M005, M025, M054	Short-term, direct, reversible, **Minor adverse**	Not Significant	This habitat is characterised as occurring on pebbles and cobbles. This habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary.
Decapod crustaceans	Low	Medium	Low	M001, M002, M005, M025, M054	**Negligible**	Not Significant	Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Common whelk	Low	Medium	Medium	M001, M002, M005, M025, M054	Short-term, direct, reversible, **Minor adverse**	Not Significant	Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Bivalve molluscs	Low	Medium	Medium	M001, M002, M005, M025, M054	Short term, direct, reversible, **Minor adverse**	Not Significant	Bivalve species identified within the Offshore Project Boundary require areas of soft sediment. Avoidance of these areas (where practicable) will further reduce the potential for adverse impacts. Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Edible sea urchin	Low	Medium	Low	M001, M002, M005, M025,	**Negligible**	Not Significant	Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
				M054			habitat is considered reversible with recovery expected within 5 years.
Cuttlefish	Low	Medium	Medium	M001, M002, M005, M025, M054	Short-term, direct, reversible, **Minor adverse**	Not Significant	Disturbance is not anticipated to lead to changes to the population of species. The disturbance of supporting habitat is considered reversible with recovery expected within 5 years.
Blue carbon receptors *(kelp beds, brittle star beds)*	Low	High	Medium	M001, M002, M005, M025, M054	Short-term, direct, reversible, **Minor adverse**	Not Significant	See commentary above for 'kelp beds'.

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11.9.4 TEMPORARY INCREASE IN SUSPENDED SEDIMENT CONCENTRATION AND TURBIDITY

11.9.4.1 Increases in suspended sediments have the potential to impact Benthic and Intertidal Ecology receptors, through changing levels of light penetration, clogging gills, reducing prey availability and causing mobile species such as decapods to relocate, which could increase the potential for predation. Sessile species and those that filter feed are more likely to be impacted by increases in SSCs as they have reduced ability to avoid these areas. The maximum design scenario relating to temporary increase in SSCs and turbidity during the operation and maintenance phase are presented in **Table 11-14**.

Magnitude

11.9.4.2 The magnitude of impact is based on the criteria detailed in Section 11.5.3.6 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-28**.

11.9.4.3 O&M activities within the Offshore Project Boundary are expected to result in increases in SSCs and localised sediment deposition during cable repair, replacement and reburial operations. These maintenance activities are expected to be undertaken using the same methods as those used during installation, with jet trenching representing the worst-case scenario in terms of sediment disturbance and resulting increases in SSCs and associated deposition.

11.9.4.4 Any increases in SSCs and associated deposition during O&M are expected to be of the same or lower magnitude than those assessed for the construction phase. It is acknowledged that repair and replacement of Array Cables; and the reburial/protection replacement of exposed Array Cable sections could occur on multiple occasions – up to 9 and 6 times respectively - over the Offshore Project's operational life which may result in a greater frequency of localised sediment disturbance events compared to the construction phase. However, each event will be over a smaller spatial and temporal scale than the construction phase of the Offshore Project, thus reducing the magnitude.

11.9.4.5 Elevated SSCs during the O&M phase are expected to be short-term, intermittent, and spatially limited. SSC is predicted to be highly localised and reversible through natural processes, including wave action, tidal action and prevailing currents as detailed in **Chapter 9, Volume 2a**. Activities associated with O&M are expected to occur with a lower intensity than those during construction. Although maintenance activities generating increased suspended solids will be for short durations for each sediment generating event, they will occur over the duration of the Offshore Project lifecycle, as such, there is potential for reoccurring impacts to Benthic and Intertidal Ecology receptors to occur. As such, the magnitude of impact is assessed as **Low** meaning that the impact may lead to partial loss and/or recoverable alteration to the extent, composition or character of a habitat/community, or population of a species, with reversal of impacts within 5 years or less.

Sensitivity or value of receptor

11.9.4.6 The high value habitats of annex I bedrock/stoney reef, kelp beds, tide-swept algal communities, offshore subtidal sands and gravels, *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment, and blue carbon receptors have been assigned a high ecological value, based upon criteria determined in Section 11.8.2 of this chapter. The sensitivities of these habitats temporary increase in suspended sediments during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.2 which are based on criteria provided in **Table 11-11**.

11.9.4.7 The low value habitats of Circalittoral mixed sediments and *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment have been assigned a low ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these habitats to temporary increase in suspended solids during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.2.

11.9.4.8 Regarding shellfish species, the 4 decapod species, common whelk, the 3 bivalve mollusc species, edible sea urchin and cuttlefish have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these receptors to the Temporary increase in SSCs during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.2.

Significance of effect

11.9.4.9 O&M activities are anticipated to generate increased suspended sediment and turbidity in the water column. Considering the embedded mitigation described in **Table 11-15**, the effects of a temporary increase in SSC and turbidity on Benthic and Intertidal Ecology receptors are detailed in **Table 11-28**.

Table 11-28: Significance of effect of temporary increase in suspended sediment concentration and turbidity to Benthic and Intertidal Ecology receptors during the O&M phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stoney reef	Low	High	Medium	M005, M025	Long-term, direct, reversible, **Minor adverse**	Not significant	Habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Kelp beds	Low	High	Medium	M005, M025	Long-term, direct, reversible, **Minor adverse**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Tide-swept algal communities	Low	High	Low	M005, M025	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact. The area of habitat affected is small and

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							disturbance is considered reversible with recovery expected within 5 years.
Offshore subtidal sands and gravels	Low	High	Negligible	M005, M025	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Negligible	M005, M025	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Circalittoral mixed sediments	Low	Low	Medium	M005, M025	Long-term, direct, reversible, **Minor adverse**	Not significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of the UK coastline and not restricted to the Offshore Project Boundary. The area of habitat

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							affected is small and disturbance is considered reversible with recovery expected within 5 years.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Negligible	M005, M025	**Negligible**	Not significant	The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Decapod crustaceans	Low	Medium	Low	M005, M025	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years.
Common whelk	Low	Medium	Low	M005, M025	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years.
Bivalve molluscs	Low	Medium	Low	M005, M025	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years.
Edible sea urchin	Low	Medium	Negligible	M005, M025	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years.
Cuttlefish	Low	Medium	Negligible	M005, M025	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Blue carbon receptors (kelp beds and brittlestar beds).	Low	High	Medium	M005, M025	Long-term, direct, reversible, **Minor adverse**	Not significant	See commentary above for ‘kelp beds’ and ‘brittlestar beds’.

Further Environmental Mitigation and Residual Effect

11.9.4.10 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.9.5 TEMPORARY INCREASE IN SEDIMENT DEPOSITION FROM MOBILISED SEDIMENT

11.9.5.1 Increases in deposition of suspended sediments have the potential to impact Benthic and Intertidal Ecology receptors, through smothering of habitats and sessile organisms, clogging gills, reducing prey availability and causing mobile species such as decapods to relocate, which could increase the potential for predation. Habitats and sessile organisms are more likely to be impacted by smothering than mobile species, which are able to avoid areas of increased sediment deposition or to excavate themselves from sediment deposits. The maximum design scenario relating to temporary increase in suspended sediment deposition during the O&M phase are presented in **Table 11-14**.

Magnitude

11.9.5.2 The magnitude of impact is based on the criteria detailed in Section 11.5.3.6 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-29.**

11.9.5.3 O&M activities within the Offshore Project Boundary are expected to result in increased localised sediment deposition during cable repair, replacement and reburial operations. These maintenance activities are expected to be undertaken using the same methods as those used during installation, with jet trenching representing the worst-case scenario in terms of sediment disturbance and subsequent sediment deposition.

11.9.5.4 Any increases in sediment deposition during O&M are expected to be of the same or lower magnitude than those assessed for the construction phase (see **Chapter 9, Volume 2a**).

11.9.5.5 Elevated levels of deposition during the O&M phase are expected to be short-term, intermittent, and spatially limited. Deposition is predicted to be highly localised and naturally reversible through tidal processes. It is acknowledged that repair and replacement of Array Cables; and the reburial/protection replacement of exposed Array Cable sections could occur on multiple occasions – up to 9 and 6 time respectively - over the Offshore Project's operational life which may result in a greater frequency of localised sediment deposition events compared to the construction phase. However, each event is expected to be of short duration (most likely <1 hour, but potentially up to 12 hours (see **Appendix 9.2, Volume 2c**)) which will occur over the duration of the Offshore Project lifetime of up to 35 years. This will result in a long-term, temporary, localised and reversible impact to Benthic and Intertidal Ecology receptors. As such, the magnitude of impact is assessed as

Low. This is because changes to baseline conditions are considered within the range of natural variability.

Sensitivity or value of receptor

11.9.5.6 The high value habitats of annex I bedrock/stoney reef, kelp beds, tide-swept algal communities, offshore subtidal sands and gravels, *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment, and blue carbon receptors have been assigned a high ecological value, based upon criteria determined in Section 11.8.3 of this chapter. The sensitivities of these habitats to temporary increased in sediment deposition during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.3 which are based on the criteria provided in **Table 11-11**.

11.9.5.7 The low value habitats of Circalittoral mixed sediments and *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment have been assigned a low ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these habitats to temporary increase in sediment deposition during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.3.

11.9.5.8 Regarding shellfish species, the 4 decapod species, common whelk, the 3 bivalve mollusc species, edible sea urchin and cuttlefish have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these receptors to the Temporary increase in se3diment deposition during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.3.

Significance of effect

11.9.5.9 O&M activities are anticipated to result in increased sediment deposition. However, the tidal conditions and currents within the Offshore Project Boundary are likely to remobilise deposited sediment quickly and reduce the amount of time it is present. Considering the embedded mitigation detailed in **Table 11-15**, residual effects of a temporary increase in sediment deposition from mobilised sediment on Benthic and Intertidal Ecology receptors are detailed in **Table 11-29**.

Table 11-29: Residual significance of effect of temporary increase in sediment deposition to benthic and intertidal ecology receptors during the O&M phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Residual significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Low	M005, M025	**Negligible**	Not significant	These habitats are characterised by wave action and strong tidal flows, thus reducing the residency times for any deposited sediment. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Kelp beds	Low	High	Low	M005, M025	**Negligible**	Not significant	These habitats are characterised by wave action and strong tidal flows, thus reducing the residency times for any deposited sediment. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Tide-swept algal communities	Low	High	Low	M005, M025	**Negligible**	Not significant	These habitats are characterised by wave action and strong tidal flows, thus reducing the residency times for any deposited sediment. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Offshore tidal sands and gravels	Low	High	Medium	M005, M025	Long-term, direct, reversible, **Minor adverse**	Not significant	The long-term nature of this impact is derived from the operational length of the Offshore Project. Each event resulting in increases in suspended sediments will be discrete and likely to of a short duration to the currents and tidal action present within the Offshore Project Boundary. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Residual significance of effect	Significance	Commentary
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Medium	M005, M025	Long-term, direct, reversible, **Minor adverse**	Not significant	The long-term nature of this impact is derived from the operational length of the Offshore Project. Each event resulting in increases in suspended sediments will be discrete and likely to of a short duration to the currents and tidal action present within the Offshore Project Boundary. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Circalittoral mixed sediments	Low	Low	Medium	M005, M025	Long-term, direct, reversible, **Minor adverse**	Not significant	The long-term nature of this impact is derived from the operational length of the Offshore Project. Each event resulting in increases in suspended sediments will be discrete and likely to of a short duration to the currents and tidal action present within the Offshore Project Boundary. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Medium	M005, M025	**Negligible**	Not significant	These habitats are characterised by wave action and strong tidal flows, thus reducing the residency times for any deposited sediment. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Residual significance of effect	Significance	Commentary
Decapod crustaceans	Low	Medium	Negligible	M005, M025	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years.
Common whelk	Low	Medium	Low	M005, M025	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years.
Bivalve molluscs	Low	Medium	Negligible	M005, M025	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years.
Edible sea urchin	Low	Medium	Low	M005, M025	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years.
Cuttlefish	Low	Medium	Negligible	M005, M025	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years.
Blue carbon receptors (kelp beds, brittlestar beds).	Low	High	Medium	M005, M025	Long-term, direct, reversible, **Minor adverse**	Not significant	See above commentary for 'kelp beds' and 'brittlestar beds'.

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Further Environmental Mitigation and Residual Effect

11.9.5.10 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.9.6 INTRODUCTION AND COLONISATION BY INVASIVE NON-NATIVE SPECIES

11.9.6.1 The increased risk of introduction of INNS during the O&M phase, may arise from increase vessel traffic as part of O&M operations. Furthermore, the placement of rock armour can also provide suitable habitats for the establishment and further spread of INNS. The introduction and establishment of INNS has the potential to result in changes to species composition, increased competition for resources (including space and food sources) and potential increased predation on native species. Once established, eradication of INNS is difficult to achieve, therefore the introduction of INNS is likely to result in an irreversible impact. The maximum design scenario relating to introduction and colonisation by INNS during the operation and maintenance phase are presented in **Table 11-14**.

Magnitude

11.9.6.2 The magnitude of impact is based on the criteria detailed in Section 11.5.3.6 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-30.**

11.9.6.3 O&M activities within the Offshore Project Boundary have the potential to introduce INNS species through increased vessel traffic (introduction from vessel hulls, release of bilge and ballast water) and introduction of rock protection for scour and cable protection repairs during the Offshore Project's lifetime of up to 35 years. The length of the operational phase of the Offshore Project (up to 35 years) provides more opportunities for introduction than the construction phase (5 years), therefore has a greater potential for introduction. To reduce this potential spread the Applicant is committed to producing and adhering to an INNS Management Plan which details mitigation and monitoring measures that the Project will implement to prevent and reduce impacts from the introduction of INNS. To prevent the likelihood of introductions all Offshore Project Vessels shall adhere to the International Maritime Organisation (IMO) best practice guidance including Biofouling Guidelines and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (IMO, 2021 & 2023). To aid in the early detection of potential INNS biosecurity surveillance, monitoring and reporting procedures are outlined, early detection will increase the likelihood of successful containment and the potential for full eradication. Following the mitigation and monitoring measures set out in the **Invasive Non-Native Species Management Plan**, **Volume 3**, the introduction and colonisation by INNS will result in a **Low** magnitude of impact to Benthic and Intertidal Ecology receptors. This is because changes to baseline conditions are considered within the range of natural variability.

Sensitivity or value of receptor

11.9.6.4 The introduction of INNS through changes to habitat type and construction of infrastructure as well as increased vessel traffic has the potential to impact Benthic and Intertidal Ecology receptors. The introduction of INNS has the potential to result in changes to species composition, increased competition for resources, including space and food sources and potential increased predation on native species.

High value habitats

11.9.6.5 The high value habitats of annex I bedrock/stoney reef, kelp beds, tide-swept algal communities, offshore subtidal sands and gravels and *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment have been assigned a high ecological value, based upon criteria determined in Section 11.8.3 of this chapter. The sensitivities of these habitats to the introduction and colonisation by INNS during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.6 which are based on the criteria provided in **Table 11-11**.

Low value habitats

11.9.6.6 The low value habitats of Circalittoral mixed sediments and *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment have been assigned a low ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these habitats to the introduction and colonisation by INNS during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.6.

Shellfish species

11.9.6.7 Regarding shellfish species, the 4 decapod species, common whelk, the 3 bivalve mollusc species, edible sea urchin and cuttlefish have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these receptors to the introduction and colonisation by INNS during O&M are the same as the sensitivities reported for construction, as detailed in Section 11.8.6.

Significance of effect

11.9.6.8 O&M activities have the potential to introduce INNS into the environment which could then colonise the Offshore Project infrastructure. Considering the commitments described in **Table 11-15** and the mitigation measures set out in **Invasive Non-Native Species Management Plan, Volume 3**. The effects of the potential introduction and colonisation of INNS on Benthic and Intertidal Ecology receptors are detailed in **Table 11-30**.

Table 11-30: Significance of effect of the introduction and colonisation by invasive non-native species to benthic and intertidal ecology receptors during the O&M phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Negligible	M006	**Negligible**	Not significant	Changes to baseline conditions within the range of natural variability.
Kelp beds	Low	High	Negligible	M006	**Negligible**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.
Tide-swept algal communities	Low	High	Low	M006	**Negligible**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.
Offshore subtidal sands and gravels	Low	High	Medium	M006	Long-term, non-reversible, indirect **Minor adverse**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Medium	M006	Long-term, non-reversible, indirect	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
					Minor adverse		
Circalittoral mixed sediments	Low	Low	High	M006	Long-term, non-reversible, indirect **Minor adverse**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Medium	M006	Long-term, non-reversible, indirect **Minor adverse**	Not significant	Partial loss and/or recoverable alteration to the extent, composition or character of the habitat with reversal of impacts anticipated within 5 years.
Decapod crustaceans	Low	Medium	Negligible	M006	**Negligible**	Not significant	Changes to baseline conditions within the range of natural variability
Common whelk	Low	Medium	Low	M006	**Negligible**	Not significant	N/A
Bivalve molluscs	Low	Medium	Low	M006	**Negligible**	Not significant	N/A
Edible sea urchin	Low	Medium	Negligible	M006	**Negligible**	Not significant	N/A
Cuttlefish	Low	Medium	Low	M006	**Negligible**	Not significant	N/A

Further Environmental Mitigation and Residual Effect

11.9.6.9 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.9.7 ELECTROMAGNETIC FIELD EFFECTS

11.9.7.1 The production of EMF during the operational phase of the Offshore Project has the potential to impact benthic species, notably decapod crustaceans through changes to behaviour, notably reduced mobility, production of a stress response and attraction to EMFs.

Magnitude

11.9.7.2 The magnitude of impact is based on the criteria detailed in Section 11.5.3.6 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-31.**

11.9.7.3 The installation of Array Cables to Final WTG and Array Cables to Landfall/Export Cables to Landfall will result in High Voltage Alternating Current (HVAC) under the maximum design scenario outlined in **Table 11-14**. EMFs are generated by 2 main components: electric fields (E-fields) and magnetic fields (B-fields). The strength of these fields depends on the amount of current and voltage flowing through the cables.

11.9.7.4 Magnetic fields generated during energy transmission are not shielded by cable insulation and can extend into the surrounding water. The strength of these fields varies depending on the amount of current flowing through the cable and can be detected by species sensitive to magnetic fields (magnetosensitive species). Unlike magnetic fields, electric fields generated by subsea cables are usually contained within the cable's insulation, so under normal conditions, marine species are not directly exposed to the electric field itself (SEER, 2022). However, when a conductor (like a fish or seawater from tidal movement) moves through the produced magnetic field, it can induce a secondary electric field, called an induced electric field (iE-field). Induced electric fields can be detectable by species sensitive to electric fields (electrosensitive species). Alternating current (AC) cables have the potential to produce weak induced electric fields in the range of microvolts per metre (μV/m). Background measurements of the magnetic field are approximately 50 μT in the North Sea, and the naturally occurring electric field in the North Sea is approximately 25 μV/m. The calculated background magnetic field in the Array Area is slightly higher than the world average, approximately 50.74 μT (based on the World Magnetic Model[13]).

[13] NCEI Geomagnetic Calculators

11.9.7.5 The potential EMF produced by the Offshore Project has been modelled and is reported in **Chapter 12, Volume 2a.** The maximum design scenario and maximum assessment assumptions that informed the modelling and subsequently this assessment are outlined in **Table 11-14**.

11.9.7.6 The findings of the study were that induced EMF produced by the Offshore Project returned to background levels within 1 m of the cable (1 m above the cable and ~2 m either side), with a maximum strength of 100 µT recorded within 50 cm of the cables. As this will be generated across all cables and will be produced for the duration of the Offshore Project (up to 35 years), the duration of impact will be long-term, and reversible on decommissioning. Therefore, the magnitude of impact is considered to be **Low**. This is because changes to baseline conditions are considered within the range of natural variability.

Sensitivity or value of receptor

11.9.7.7 The sensitivity of benthic species to EMF emissions depends on which species are associated with the benthic habitats under consideration. Outside of small number of laboratory investigations, there is sparse information regarding the sensitivity of benthic species to EMF. Key conclusions from the existing body of literature comprise:

- Mussels *Mytilus edulis*, shrimp *Crangon crangon* and crabs *Rhithropanopeus harrisii* exhibited no differences in survival rates when exposed to a static B-field of 3,700 µT for 3 months (Bochert and Zettler, 2006);
- Subtle behavioural responses to HVDC have been observed in American lobsters *Homarus americanus*, but this did not present a barrier to their movements and was not deemed to have a significant impact. (Hutchinson *et al*., 2018);
- There is no evidence of Rag worm *Hediste diversicolor* displaying avoidance or attraction behaviours to EMF of 1000 µT (Jakubowska *et al*., 2019);
- The edible crab (Cancer Pagurus) was found to have limited physiological and behavioural impacts in response to an EMF intensity of 250 µT. Edible crabs have exhibited stress response and attraction to EMF strengths of 500 µT and 1000 µT, but not with an overall impact to their movements (Scott *et al*., 2021);
- An increased occurrence of developmental deformities have been observed in embryonic edible crab and European lobster *Homarus gammarus*, when exposed to 2.8 mT under lab conditions (Harsanyi *et al*., 2022). However, the larval stages of these species are predominantly pelagic, as opposed to benthic. Thus, EMF emissions are not anticipated to affects the embryonic life stages of species within the water column;
- No significant differences were found in either behavioural or physiological responses of common periwinkle *Littorina littorea,* edible sea urchins *Echinus esculentus,* common starfish *Asterias rubens,* or velvet crabs *Necora puber* to an EMF of 500 µT (Chapman *et al*., 2023).

11.9.7.8 Where studies have disclosed specific EMF intensities, these far exceed the maximum strength that will be produced by the Offshore Project (100 µT within 50 cm of the cable). While the number of studies addressing EMFs and benthic species are limited, the receptor groups the literature encompasses are considered to be representative of the many species which inhabit the benthic habitats under consideration in this assessment. Therefore, with consideration of the body of evidence and EMF modelling for the Offshore Project, it is understood that detection by invertebrate species associated with benthic habitats may be possible, but that at the levels of EMF produced by the Offshore Project, combined with the quick dissipation of field strength, and the burial of cables increasing distance between source and species (FeAST, 2025a) mean that receptors responses to EMF are either minimal or absent. As such, the following receptors are considered to have a **Low** to **Negligible** sensitivity to EMF, in line with the criteria provided in **Table 11-11**.

11.9.7.9 As indicated above, there is insufficient evidence in the current literature to demonstrate a pathway between EMF exposure and the following receptors:

High value habitats

- Annex I Bedrock and/or Stony Reef;
- Kelp Beds;
- Tide-swept algal communities;
- Offshore subtidal sands and gravels;
- *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment.

Low value habitats

- Circalittoral Mixed Sediments;
- *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment.

11.9.7.10 Therefore, the sensitivity to the effects of EMF is deemed to be **Negligible**, for these receptors.

Shellfish species

11.9.7.11 A review of the sensitivities of a range of benthic invertebrates to EMF undertaken by Normandeu (2011) concluded that there was no direct evidence to support impacts from subsea cables on invertebrate species. This was based upon the fact that although a range of invertebrate species are sensitive to EMF during laboratory experiments, the levels at which responses/impacts are observed are orders of magnitude higher than those generated in the field.

Decapod Crustaceans

11.9.7.12 For decapod crustaceans, the sensitivity of brown crab has been used as a proxy for sensitivity to EMF. Laboratory studies undertaken by Scott *et al.* (2021) reported that at field strengths of less than 250 µT no changes to behaviour or stress response were observed in brown crab. Scott *et al.* (2021) reported that behavioural responses such as attraction and production of a stress response occurred at field strengths above 500 µT. Therefore, the sensitivity of decapod crustaceans to this impact is considered to be **Low**, precautionarily.

Common Whelk

11.9.7.13 There is limited information available on the effects of EMF on common whelk, however Chapman *et al.* (2023) undertook EMF experiments on the gastropod *Littorina littorea* and reported that no effects were observed when individuals were exposed to EMF of 500 µT. Therefore, the sensitivity of common whelk to this impact is considered to be **Negligible**.

Bivalve molluscs

11.9.7.14 Limited information is available on the impacts of EMF on dog cockle, king scallop and razor clam, however studies by Jakubowska-Lehrmann *et al.* (2022) on the cockle *Cerastoderma glaucum* can be used as a proxy. Jakubowska-Lehrmann *et al.* (2022) exposed *C. glaucum* to EMF of 6.4 mt (6400 µT) and observed no impacts to feeding rates, but a 21 % reduction rate in ammonia excretion rate, which equates to a very low effect bioenergetically. This suggests a limited sensitivity of *C. glaucum* to exposure to EMF. Therefore, the sensitivity of bivalve molluscs to this impact is considered to be **Negligible**.

Edible sea urchin

11.9.7.15 Studies by Chapman *et al*. (2023) investigating the effects on behaviour, haemocyte count and righting reflex in edible sea urchin found that there were no significant changes at EMF at strength of 500 µT. Therefore, the sensitivity of edible sea urchin to this impact is considered to be **Negligible**.

Cuttlefish

11.9.7.16 Limited information is available on the effects of EMF on cuttlefish; however, they lack the specialised organs typically associated with electroreception. In light of this, the sensitivity of cuttlefish to this impact has been considered to be **Low**, as a precautionary approach.

Significance of effect

11.9.7.17 The use of subsea electric cables during the O&M stage of the Offshore Project is anticipated to introduce EMF into the environment. Considering the embedded mitigation described in **Table 11-15**, residual effects of EMF effects from subsea electrical cables on Benthic and Intertidal Ecology receptors are detailed in **Table 11-31**.

Table 11-31: Significance of effect of EMF from subsea electrical cables to benthic ecology receptor during the O&M phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Negligible	M002	**Negligible**	Not significant	There is limited evidence to suggest that habitats are sensitive to EMF.
Kelp beds	Low	High	Negligible	M002	**Negligible**	Not significant	There is limited evidence to suggest that habitats are sensitive to EMF.
Tide-swept algal communities	Low	High	Negligible	M002	**Negligible**	Not significant	There is limited evidence to suggest that habitats are sensitive to EMF.
Offshore subtidal sands and gravels	Low	High	Negligible	M002	**Negligible**	Not significant	There is limited evidence to suggest that habitats are sensitive to EMF.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Negligible	M002	**Negligible**	Not significant	There is limited evidence to suggest that habitats are sensitive to EMF.
Circalittoral mixed sediments	Low	Low	Negligible	M002	**Negligible**	Not significant	There is limited evidence to suggest that habitats are sensitive to EMF.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Negligible	M002	**Negligible**	Not significant	There is limited evidence to suggest that habitats are sensitive to EMF.
Decapod crustaceans	Low	Medium	Low	M002	**Negligible**	Not significant	The EMF generated by the Offshore Project are below those at which responses have been observed in decapod crustaceans. In addition, the cables will either be buried 1 m below the

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							surface, or covered by rock protection, which has the potential to reduce exposure to EMF above background levels.
Common whelk	Low	Medium	Negligible	M002	**Negligible**	Not significant	There is limited or no evidence to suggest sensitivity to EMF.
Bivalve molluscs	Low	Medium	Negligible	M002	**Negligible**	Not significant	There is limited or no evidence to suggest sensitivity to EMF.
Edible sea urchin	Low	Medium	Negligible	M002	**Negligible**	Not significant	There is limited or no evidence to suggest sensitivity to EMF.
Cuttlefish	Low	Medium	Low	M002	**Negligible**	Not significant	There is limited or no evidence to suggest sensitivity to EMF.

Further Environmental Mitigation and Residual Effect

11.9.7.18 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.9.8 THERMAL EMISSIONS EFFECTS

11.9.8.1 Heat generated through emissions from subsea cables have the potential to impact habitats and species through changes to the existing temperature regime, for both sediments directly in contact with the cables and the overlying water column. Even modest changes in sediment and water temperature can alter the physical and chemical characteristics of the seafloor. Elevated sediment and water temperature can reduce oxygen levels and potentially influence microbial processes and nutrient cycling (Rhoads and Boyer, 1982; OSPAR, 2008). However, the direct effects of this warming on benthic organisms are not well-studied, and much of current understanding comes from species-specific tolerance data.

Magnitude

11.9.8.2 The magnitude of impact is based on the criteria detailed in Section 11.5.3.6 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-32.**

11.9.8.3 When electricity flows through subsea power cables, a small portion of that energy is lost as heat. This heat, also referred to as thermal emissions, can raise the temperature of the cable surface and, to a lesser extent, the surrounding sediment and seawater (OSPAR, 2009; Boehlert and Gill, 2010).

11.9.8.4 Array Cables to Landfall transmitting at maximum voltage (132 kV) are assumed to have the potential to generate elevated heat levels over the greatest area, which could affect nearby sediment temperature (see **Table 11-14**). For context, field observations from the Nysted offshore wind farm (Meißner, 2006) recorded temperature increases of up to 2.5°C in sediments 50 cm beneath 33 kV and 132 kV cables buried at a depth of around 1 m in medium sand. Given that this Offshore Projects cable voltage is within or below this range, similar or slightly lower thermal effects are expected. Despite the limited number of detailed studies on thermal effects from subsea cabling, the evidence suggests that any changes to sediment temperature will be localised, and unlikely to disrupt wider benthic ecological processes as mentioned above, such as microbial processes, reductions in oxygen levels and nutrient cycling (Boehlert and Gill, 2010; Taormina *et al.*, 2018). Furthermore, in water heat dissipates rapidly. Thus, the potential for thermal impacts from surface laid cables on benthic receptors is not expected to exceed that presented by buried cables, due to extremely localised effects (OSPAR Commission, 2023), particularly when covered by rock protection.

11.9.8.5 Therefore, the magnitude of impacts is considered to be no greater than **Low** due to partial loss and/or recoverable alteration to the extent, composition or character of a habitat/community, or population of a species, with recovery expected within less than 5 years.

Sensitivity or value of receptor

High value habitats

11.9.8.6 The sensitivity described for each receptors is based on the criteria provided in **Table 11-11.**

Annex I Bedrock and/or Stony Reef

11.9.8.7 Annex I bedrock/stoney reef has been assessed by MarLIN as having a negligible to low sensitivity to increases in water temperature (Stamp *et al.,* 2023a, Tillin *et al.,* 2023). This sensitivity is based upon the ability of the species comprising this habitat type to tolerate increases in temperature and their ability to recover from increases in temperature. Therefore, the sensitivity to this impact is considered to be **Low**.

Kelp Beds

11.9.8.8 Kelp beds have been assessed by MarLIN as having a medium sensitivity to increases in water temperature (Stamp *et al.,* 2023b). This sensitivity is derived from kelp beds having a medium tolerance to increases in temperature, with a medium ability to recover. It should be noted that the water temperature range for kelp beds is between 0-20°C. Therefore, the sensitivity to this impact is considered to be **Medium**.

Tide-swept algal communities

11.9.8.9 Tide-swept algal communities are considered by the FeAST tool to have a low sensitivity to Increase in water temperature. FeAST uses the benchmark of surface water temperature change of 5°C for a month, or 2°C for a year. Therefore, in light of their tolerance, the sensitivity to this impact is considered to be **Low**.

Offshore Subtidal Sands and Gravels under the illustrative biotopes: A5.14 Circalittoral coarse sediment; A5.25 Circalittoral fine sand; A5.26 Circalittoral muddy sand

11.9.8.10 Offshore subtidal sands and gravels are considered by the FeAST tool under the illustrative biotopes: A5.14 Circalittoral coarse sediment; A5.25 Circalittoral fine sand; and A5.26 Circalittoral muddy sand (Tide swept coarse sands with burrowing bivalves) to have a low sensitivity to increases in water temperature (FeAST, 2023)[11]. Based upon the species present within the Offshore Project Boundary – including their medium-high tolerance and recoverability - the sensitivity to this impact is considered to be **Low**.

A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment

11.9.8.11 A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment has been assessed by MarLIN as having a negligible sensitivity to increases in temperature (De-Bastos *et al*., 2023). This has been derived from a high tolerance and high ability to recover from increases in temperature. Therefore, the sensitivity to this impact is considered to be **Negligible**.

Low value habitats

A5.44 Circalittoral Mixed Sediments

11.9.8.12 A5.44 Circalittoral mixed sediments (Tide swept coarse sands with burrowing bivalves) are considered by the FeAST tool to have a low sensitivity to changes in water temperature (FeAST, 2023)[12]. Therefore, the sensitivity to this impact is considered to be **Low**.

A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment

11.9.8.13 A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment has been assessed by MarLIN as having a negligible sensitivity to increases in water temperature (Readman and Watson, 2024). This is based upon a high tolerance to changes and a high ability to recover following exposure. Therefore, the sensitivity to this impact is considered to be **Negligible.**

Shellfish species

Decapod Crustaceans

11.9.8.14 For decapod crustaceans, the sensitivity of Norway lobster and brown crab have been used to determine the sensitivity to thermal emissions from subsea cables. Norway lobster have been assessed by MarLIN as having a very low sensitivity to increases in temperature (Hill and Sabatini 2008). This sensitivity has been derived from the fact that Norway lobster has a wide distribution across Europe, being recorded from the North coast of Scotland/*Alba* to the Mediterranean. It has been assessed as having a high tolerance to increases in temperature and a high ability to recover from increases. Brown crab have been assessed by MarLIN as having a low sensitivity to increases in temperature, based upon a medium tolerance and high ability to recover. Therefore, the sensitivity to this impact is considered to be **Low**.

Common Whelk

11.9.8.15 Although data is available on the effects of increasing water temperatures on common whelk (i.e. faster growth, limited adult size) (Emmerson *et al.,* 2020) limited information is available on the effects of increased sediment temperature. It should be noted that common whelk are recorded across a wide geographic area and have a reported water temperature tolerance range of between 0-22°C (Emmerson *et al.,* 2020). This suggests some form of tolerances to a wide range of water temperatures. Therefore, the sensitivity to this impact is considered to be **Low**.

Bivalve molluscs

11.9.8.16 There are 3 commercial species of bivalve, razor clam, king scallop and dog cockle that have been recorded within the Study Area, with the sensitivity of razor clams being used to determine the sensitivity of bivalves. Razor clams have been assessed by MarLIN as having a low sensitivity to increases in water temperature (Hill 2024). This sensitivity has been derived from a medium tolerance and a high ability to recover following exposure. MarLIN considers increases in water temperature of 5°C over 3 days as being acute (short term) and 2°C increase over a year as a chronic change (long term). Therefore, the sensitivity to this impact is considered to be **Low.**

Edible sea urchin

11.9.8.17 Edible sea urchin have been assessed by MarLIN as having a low sensitivity to increases in water temperatures of 5°C over a month of 2°C over a year (Tyler-Walters 2008). This sensitivity has been derived from a medium tolerance and high ability to recover. Therefore, the sensitivity to this impact is considered to be **Low**.

Cuttlefish

11.9.8.18 Cuttlefish have been assessed by MarLIN as having a medium sensitivity to increases in water temperatures of 5°C over a month and of 2°C over a year (Gibson-Hall and Wilson 2018). This is based upon a medium tolerance and medium-term ability to recover following water temperature increases. It should be noted however, that cuttlefish have a wide distribution and the temperature limits of this species are expected to be within 10-30 °C. Therefore, the sensitivity to this impact is considered to be **Medium**.

Significance of effect

11.9.8.19 The use of subsea electric cables during the O&M stage of the Offshore Project is anticipated to introduce thermal emissions into the environment. Considering the embedded mitigation described in **Table 11-15**, the effects of thermal emissions from subsea electrical cables on Benthic and Intertidal Ecology receptors are detailed in **Table 11-32**.

Table 11-32: Significance of effect of thermal emissions from subsea electrical cables to benthic ecology receptors during the O&M phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Low	M002	**Negligible**	Not significant	N/A
Kelp beds	Negligible	High	Medium	M002	**Negligible**	Not significant	The use of HDD to bury cables under the intertidal zone and avoid the majority of the Kelp beds, further reduces the potential for impacts to this habitat. In addition, kelp beds can tolerate water temperatures between 0-20°C, which is unlikely to be exceeded within the Offshore Project Boundary. For context, sea water temperatures on the Lewis coastline at Stornoway/*Steòrnabhagh* vary annually between 10.9ºC and 15.9ºC (seatemperature.info, 2023).
Tide-swept algal communities	Negligible	High	Low	M002	**Negligible**	Not significant	The use of HDD to bury cables under the intertidal zone and avoid the majority of tide-swept algal communities further reduces the potential for impacts to this habitat.
Offshore subtidal sands and gravels	Low	High	Low	M002	**Negligible**	Not significant	The species present within this habitat are typically buried within the top 30 cm of the sediment and thus are less likely to be influenced by increased temperatures.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Negligible	M002	**Negligible**	Not significant	N/A

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Circalittoral mixed sediments	Low	Low	Low	M002	**Negligible**	Not significant	N/A
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Negligible	Low	Negligible	M002	**Negligible**	Not significant	This habitat is characterised by areas of tidal flow, this potentially increasing the amount of water flow and potentially reducing the potential from effects from thermal emissions.
Decapod crustaceans	Low	Medium	Low	M002	**Negligible**	Not significant	N/A
Common whelk	Negligible	Medium	Low	M002	**Negligible**	Not significant	Increased sediment temperature is limited to 2.5°C above ambient at a depth of 50 cm below the surface. Although common whelk is known to burrow in soft sediments, they do not burrow down to this depth, therefore are unlikely to experience much temperature change.
Bivalve molluscs	Low	Medium	Low	M002	**Negligible**	Not significant	N/A
Edible sea urchin	Negligible	Medium	Low	M002	**Negligible**	Not significant	Increased sediment temperature is limited to 2.5°C above ambient at a depth of 50 cm below the surface. Edible sea urchin is not known to burrow down to this depth, therefore are unlikely to experience much temperature change.
Cuttlefish	Negligible	Medium	Medium	M002	**Negligible**	Not significant	Common cuttlefish is a cosmopolitan species and is found from the North coast of Scotland/*Alba* to the Mediterranean, and has an estimated water temperature limit between 10 and 30°C. The

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							estimated increases in sediment temperature of 2.5°C at 50 cm below the surface are unlikely to exceed the tolerances for this species, therefore no impacts are expected.

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Further environmental mitigation and residual effects

11.9.8.20 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2 is not significant in EIA terms.

11.10 ASSESSMENT OF EFFECTS: DECOMMISSIONING

11.10.1 REMOVAL OF HARD STRUCTURES

11.10.1.1 The removal of hard artificial substrates during decommissioning has the potential to result in both adverse and beneficial impacts upon Benthic and Intertidal Ecology within the Offshore Project Boundary. The removal of WTGs, rock protection, and Array Cables from areas with underlying soft sediment has the potential to increase areas of available habitat for infaunal species such as bivalves and those that burrow as part of their life history strategy (i.e. Norway lobster) thus resulting in a beneficial impact. However, for species that are adapted to living on hard substrates such as marine algae, encrusting sponges and some bivalves, it has the potential to result in adverse impacts as this habitat will be removed. The maximum design scenario relating to removal of hard structures following decommissioning of the Offshore Project are presented in **Table 11-14**.

Magnitude

11.10.1.2 The magnitude of impact is based on the criteria detailed in Section 11.5.3.6 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-33.**

11.10.1.3 Decommissioning activities within the Offshore Project Boundary are expected to follow the reverse of the construction phase of the Offshore Project, with some infrastructure left in situ. As a precautionary approach, this assessment will assume that the removal of all hard substrate installed by the Offshore Project will be removed. The magnitude of impact from decommissioning is predicted to be equivalent to or lower than that of the construction phase. This is because, unlike construction, seabed clearance is not expected to be required for foundation installation or along cable routes. Any seabed clearance during decommissioning is likely to be limited to the placement of jack-up vessel legs.

11.10.1.4 The removal of rock protection will result in areas of substrates being returned to close to their natural state and will result in areas of hard substrate such as bedrock, cobbles and boulders being exposed. The removal of hard structures will also expose other substrata, such as offshore tidal sands and gravels and mixed sediments. Removal of WTGs and Array Cables are expected to result in similar outcomes allowing for mobile sediments (where present) to naturally backfill and potentially return to the site to a comparable state to pre-construction, thus reinstating the habitat availability for benthic infauna over a short period.

11.10.1.5 It should be noted that a large proportion of species present within the Offshore Project Boundary are adapted to living on hard substrate and are likely to have colonised the rock protection. Therefore, the impacts of hard structure removal are likely to be of the same magnitude as during the construction phase, as assessed under temporary habitat disturbance (see Section 11.8.1). As such, considering the adverse nature of the impact, its limited spatial extent, partial reversibility and long-term duration, the overall magnitude of impact is assessed as **Low**. This is because changes to baseline conditions are considered within the range of natural variability.

Sensitivity or value of receptor

High value habitats

11.10.1.6 The following habitats have been assigned a high ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the decommissioning phase of the Offshore Project. The sensitivity described for each receptors is based on the criteria provided in **Table 11-11**.

Annex I bedrock/stoney reef

11.10.1.7 Annex I bedrock/stoney reef has been assessed by MarLIN as having a high sensitivity to changes in seabed type, although it should be noted that this is from hard substrates to soft sediments (Stamp *et al.,* 2023a, Tillin *et al.,* 2023). This sensitivity is based upon the fact that this habitat is only found on hard substrates.

11.10.1.8 Annex I bedrock and stony reef communities are obligately associated with hard substrata and support structurally complex faunal and algal assemblages that are not functionally replaceable by surrounding communities. Where hard substratum is lost or heavily scarred and replaced by mobile sediments, there is a near-complete shift in species composition (from sessile, encrusting and canopy-forming taxa to mobile infauna), with consequent loss of habitat complexity and associated ecosystem services (e.g. nursery habitat, bioengineering). Empirical before-after-control-impact (BACI) studies from offshore development and dredging contexts show that conversion from hard substrata leads to persistent community reconfiguration and long recovery timescales (years to decades), especially where natural recolonisation is limited by larval supply or hydrographic barriers (Irving, 2009; Beatrice monitoring, APEM 2022 recent synthesis on artificial and natural reef dynamics, Watson *et al*., 2024). The sensitivity to this impact is considered to be **High** due to the irreversible nature of true substrate replacement at the footprint scale and slow recovery trajectories documented in recent monitoring.

Kelp beds

11.10.1.9 Kelp beds have been assessed by MarLIN as having a high sensitivity to habitat loss (Stamp *et al.,* 2023b). However, it should be noted that this assessment was based upon hard substrate being replaced by other substrata as this would trigger a change in habitat type, indicating a low tolerance. Kelp requires hard substrate to adhere to, so removal and replacement of other habitat types would indicate a low ability to recover following this change.

11.10.1.10 Kelp forests (principally *Laminaria hyperborea* and related canopy kelps) are structurally dependent on stable rocky substrata for holdfast attachment and on sufficient light regimes to sustain canopy productivity. Multiple recent studies and national policy documents identify kelp as a Priority Marine Feature in Scotland/*Alba* and emphasise both ecological importance (carbon sequestration, nursery function, coastal protection) and vulnerability to substrate loss and increased sediment deposition (Farrugia-Drakard *et al*., 2023; regional surveys 2023–2024; FeAST, 2025d).

11.10.1.11 Experimental and field evidence shows that burial by fine sediments, increased turbidity and direct physical removal of rock substantially reduces juvenile recruitment, smothers holdfasts and leads to canopy collapse; recovery is often prolonged because recruitment, growth and recolonisation are dependent on spore supply and suitable hard substrate, making natural recovery slow or unlikely where the substrate itself has been lost (Farrugia-Drakard *et al*., 2023; Witte, 2024; 2024 regional resurvey of kelp decline). The Scottish Government and NatureScot explicitly recognise kelp beds as nationally important (PMF status) and require precautionary treatment of activities that may alter substrate or sediment budgets. The sensitivity to this impact is considered to be **High** due to the biotope's low tolerance to substrate replacement, slow recovery potential documented in recent field studies and high policy value attached to kelp beds in Scotland/*Alba*.

Tide-swept algal communities

11.10.1.12 Tide-swept algal communities are considered by the FeAST tool to have a low sensitivity to long term habitat loss/changes in habitat type (FeAST, 2025b). This is due to the mixed substrata (boulder, cobble, pebble, gravel and sand) that this community is found on and its ability to recolonise and recover. The removal of artificial hard substrate could provide additional habitat for this community to colonise.

11.10.1.13 Tide-swept algal assemblages on mixed substrata (wave- or tide-swept infralittoral rock and mixed sediments) are adapted to high hydrodynamic energy and exhibit high turnover and recolonisation potential, shown in both observational and experimental studies (e.g. colonisation of tide-swept artificial structures and natural rock in high-energy sites). The FeAST assessments similarly identify lower long-term sensitivity to habitat change for mixed-substratum tide-swept communities because these assemblages occupy mosaics of substrate types and can rapidly re-establish following short-term disturbance where suitable micro-substrata remain (FeAST; successional studies in high-energy marine renewable sites; Succession in epibenthic communities, 2019–2020). Therefore, the sensitivity to this impact is considered to be **Low**.

Offshore subtidal sands and gravels

11.10.1.14 Offshore subtidal sands and gravels are considered by the FeAST tool under the illustrative biotopes: A5.14 Circalittoral coarse sediment; A5.25 Circalittoral fine sand; A5.26 Circalittoral muddy sand to have a medium sensitivity to slight changes in habitat type, but a high sensitivity in large changes in habitat type (from sand/gravel to rock protection) (FeAST, 2023)[11]. Therefore, the sensitivity to this impact is considered to be **High**. Baseline surveys (grab samples, particle size analysis, and video transects) show that where sediments occur, they were represented by well-sorted sands and gravels, with limited fine material. This is fully consistent with the classification of biotopes A5.14 (Circalittoral coarse sediment), A5.25 (Circalittoral fine sand) and A5.26 (Circalittoral muddy sand) under the FeAST tool (FeAST, 2023)[11].

11.10.1.15 Multiple survey campaigns (geophysical and ground-truthing) have produced highly consistent sediment classifications, with no evidence of significant heterogeneity (Cooper *et al*., 2008; Cefas, 2020). The sediments recorded are entirely consistent with regional seabed maps and wider benthic survey datasets for the Southern and Central North Sea, which describe extensive areas of mobile sand and gravel with similar faunal assemblages (OSPAR, 2023). While seasonal or storm-driven variation in surface sediments can occur, the underlying substrate composition remains stable, meaning baseline characterisation is robust for the purposes of sensitivity assessment (Diesing and Stephens, 2020).

11.10.1.16 Circalittoral sands and gravels support diverse infaunal communities whose structure and function depend on sediment grain size, bedform dynamics and geochemical exchange. Recent synthesis and monitoring work demonstrates that incremental or transient increases in SSC/temporary deposition often lead to short-term shifts in surface fauna with rapid recovery in moderate energy settings; however, wholesale conversion of sedimentary habitats to hard substrates (e.g. emplacement of rock protection or permanent foundation footprints) represents a fundamentally different habitat and leads to loss of infaunal communities and associated functions (e.g. benthic productivity, bioturbation). Case studies and monitoring from offshore wind and infrastructure projects (e.g. SACs, Beatrice monitoring and other EIA reports) indicate that where large area-scale substrate replacement occurs, biotic recovery of original sand/gravel communities is unlikely within typical project timescales.

***Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment**

11.10.1.17 A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment has been assessed by MarLIN as having a negligible sensitivity to long term habitat loss/change (De-Bastos *et al*., 2023). This sensitivity is derived from a high tolerance and high recoverability to change in substrate type. This is due to the ability for brittlestar species (which make up the majority within this habitat type) to colonise a wide range of habitats from mud to large boulders and recruit rapidly following disturbance. Therefore, the sensitivity to this impact is considered to be **Negligible**.

11.10.1.18 Brittlestar-dominated mixed-sediment beds (e.g. *Ophiothrix fragilis*/*Ophiocomina nigra*) are widely reported to be resilient to physical disturbance and to exhibit rapid recolonisation because many ophiurids have planktonic larvae, high local dispersal and an ability to occupy a range of substrate types (gov.wales review; studies of brittlestar life histories and recolonisation). Recent monitoring and fisheries interaction reports (pots, creels) demonstrate that such beds often re-establish following physical disturbance and are among the more tolerant assemblages to changes in grain size or local displacement (Pots, Traps and Creels interactions report; growth/larval ecology literature).

Low value habitats

11.10.1.19 The following habitats have been assigned a low ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of the habitats to impacts from the decommissioning phase of the Offshore Project.

Circalittoral mixed sediments

11.10.1.20 A5.44 Circalittoral *mixed* sediments (continental shelf mixed sediments) are considered by the FeAST tool to have a high sensitivity to changes in habitat type (FeAST 2023)[12]; equating to low – no tolerance and/or recoverability. Therefore, the sensitivity to this impact is considered to be **High**.

***Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment**

11.10.1.21 A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept *circalittoral* mixed sediment has been assessed by MarLIN as having a high sensitivity to changes in sediment type from softer sediments such as sands to harder substrates such as rock and pebble (Readman and Watson, 2024). The habitat is characterised as epifauna attached to pebbles and cobbles and changes to other substrate types will alter the biological assemblage, indicating a low tolerance and low ability to recover. Therefore, the sensitivity to this impact is considered to be **High**.

Shellfish species

11.10.1.22 The following shellfish species have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. This has been considered when determining the overall sensitivity of these shellfish species to impacts from the decommissioning phase of the Offshore Project.

Decapod crustaceans

11.10.1.23 There are 4 species of decapod crustaceans have been recorded within the Study Area; Norway lobster, brown crab, pink shrimp and squat lobster. The sensitivity of 2 species; Norway lobster and brown crab have been used to determine the sensitivity of decapods found within the Offshore Project Boundary. Norway lobster have been assessed by MarLIN as having a medium sensitivity to habitat loss, as removal of suitable habitat may result in the removal of a resident population, and if suitable habitat has been lost, this species may struggle to recover (Hill and Sabatini, 2008). The preferred habitat type for Norway lobster is mud, muddy sand and sand, therefore the removal of hard substrate has the potential to provide Norway lobster with additional habitat during the decommissioning phase of the Offshore Project. Brown crab have been assessed by MarLIN as having a medium sensitivity to habitat loss, as removal of suitable habitat, including rock areas may result in the removal of a resident population, however brown crab is able to recolonise areas of suitable habitat due to the mobile nature of adults and will readily recolonise following cessation of activities (Neal and Wilson, 2008). Therefore, the sensitivity to this impact is considered to be **Low to Medium**.

Common whelk

11.10.1.24 Common whelk are recorded as present around the whole of the UK, inhabiting a wide variety of habitat types from muddy-sand, to gravels and rocky substrates and at a range of water depths from the intertidal zone, down to depths of 1,200 m (Ager, 2008). Based upon the widespread nature of this species and its ability to colonise a wide range of habitat types, it is likely to have a negligible sensitivity to habitat loss as it is able to function on rock as easily as other substrate types such as sand; thus demonstrating a high tolerance and recoverability. Therefore, the sensitivity to this impact is likely to be **Negligible**.

Bivalve molluscs

11.10.1.25 There are 3 commercial species of bivalve, razor clam, king scallop and dog cockle that have been recorded within the Study Area, with the sensitivity of razor clams being used to determine the sensitivity of bivalves. Razor clam have been assessed by MarLIN as having a medium sensitivity to habitat loss, as removal of suitable habitat may result in the removal of a resident population, and if suitable habitat has been lost, this species may struggle to recover (Hill, 2024). The preferred habitat type for razor clam is fine sand-muddy sand, therefore the removal of hard substrate has the potential to provide razor clam and other infaunal bivalves with additional habitat during the decommissioning phase of the Offshore Project. Therefore, the sensitivity to this impact is considered to be **Low to Medium**.

Edible sea urchin

11.10.1.26 Edible sea urchin have been assessed by MarLIN as having a medium sensitivity to habitat loss, as removal of suitable habitat may result in the removal of a resident population as well due to their slow movement indicating a low tolerance to habitat changes (Tyler-Walters, 2008). Sea urchin are able to colonise new areas and are able to switch feeding patterns from kelp species to other sources such as algal crusts (indicating a high recoverability). Therefore, the sensitivity to this impact is considered to be **Low to Medium.**

Cuttlefish

11.10.1.27 Cuttlefish have been assessed by MarLIN as having a medium sensitivity to habitat loss, as different life stages have different habitat requirements (Gibson-Hall and Wilson, 2018). The sensitivity is based upon a medium tolerance and medium ability to recover following changes. Adult cuttlefish are more resilient to changes in habitat; however juveniles require areas of soft sediment in which to bury to avoid predation. If areas of suitable habitat for juveniles are absent, there is the risk of potential increases in predation and impacts to cuttlefish populations. Therefore, the sensitivity to this impact is considered **Low to Medium**.

Significance of effect

11.10.1.28 The decommissioning stage of the Offshore Project will involve the removal of infrastructure, primarily hard structures. Considering the embedded mitigation described in **Table 11-15**, the effects of the removal of hard structures following decommissioning of the Offshore Project on Benthic and Intertidal Ecology receptors are detailed in **Table 11-33**.

Table 11-33: Significance of effect of removal of infrastructure following decommissioning of the Offshore Project to benthic and intertidal ecology receptors during the decommissioning phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stoney reef	Low	High	High	M020	Long-term, direct, reversible, **Minor adverse**	Not significant	Habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. Species recorded within this habitat are adapted to living on bedrock and other hard substrate. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Kelp beds	Low	High	High	M020	**Negligible**	Not significant	HDD beneath the intertidal zone will ensure the majority of kelp beds within the Offshore Project Boundary are avoided. Kelp beds are present along the coastline of Scotland/*Alba* and are not restricted to the Offshore Project Boundary. Changes to baseline conditions are considered within the range of natural variability.
Tide-swept algal communities	Low	High	Low	M020	**Negligible**	Not significant	Mainly located in the intertidal zone. The use of HDD beneath the intertidal zone will limit the magnitude of impact. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Offshore subtidal sands and gravels	Low	High	High	M020	Long-term, direct, **Minor beneficial**	Not significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of the UK coastline and not restricted to the Offshore Project Boundary. The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Negligible	M020	**Negligible**	Not significant	The area of habitat affected is small and disturbance is considered reversible with recovery expected within 5 years.
Circalittoral mixed sediments	Low	Low	High	M020	Long-term, direct, **Minor beneficial**	Not significant	This habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. Removal of hard structures has the potential to return some of the seabed to its natural state resulting in beneficial impact.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	High	M020	Long-term, direct, **Minor beneficial**	Not significant	This habitat is characterised as occurring on pebbles and cobbles. Removal of hard structures has the potential to return some of the seabed to its natural state resulting in beneficial impact.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Decapod crustaceans	Low	Medium	Low - Medium	M020	**Negligible** - Long-term, direct, **Minor beneficial**	Not significant	Removal of hard substrate and return to soft sediments may result in beneficial impacts to species that burrow, such as Norway lobster and brown crab.
Common whelk	Low	Medium	Negligible	M020	**Negligible**	Not significant	N/A
Bivalve molluscs	Low	Medium	Low - Medium	M020	**Negligible** - Long-term, direct, **Minor beneficial**	Not significant	Bivalve species identified within the Offshore Project Boundary require areas of soft sediment. Avoidance of these areas (where practicable) will further reduce the potential for adverse impacts. Removal of hard infrastructure may have beneficial impacts on bivalves' soft sediment is created due to the provision of additional habitats.
Edible sea urchin	Low	Medium	Low - Medium	M020	**Negligible** - Long-term, direct, **Minor beneficial**	Not significant	N/A
Cuttlefish	Low	Medium	Low - Medium	M020	**Negligible** - Long-term, direct, **Minor beneficial**	Not significant	Removal of hard infrastructure may have beneficial impacts on cuttlefish if soft sediment is created due to the provision of additional habitats for juveniles.

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Further environmental mitigation and residual effects

11.10.1.29 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.10.2 TEMPORARY INCREASE IN SUSPENDED SEDIMENT CONCENTRATIONS AND TURBIDITY

11.10.2.1 Increases in suspended sediments has the potential to impact Benthic and Intertidal Ecology receptors, through changing levels of light penetration, clogging gills, reducing prey availability and causing mobile species such as decapods to relocate which could increase the potential for predation. Sessile species and those that filter feed are more likely to be impacted by increases in SSCs as they have reduced ability to avoid these areas. The maximum design scenario relating to temporary increase in SSCs and turbidity during the decommissioning phase are presented in **Table 11-14**.

Magnitude

11.10.2.2 The magnitude of impact is based on the criteria detailed in Section 11.5.3.6 and **Chapter 5, Volume 1a**. A description of the likely magnitude of impact is given in the following paragraphs. Magnitude of impact per receptor, and outline commentary, is also provided the following paragraphs, and summarised in **Table 11-34.**

11.10.2.3 Decommissioning activities within the Offshore Project Boundary are expected to follow the reverse of the construction phase of the Offshore Project, with some infrastructure left in place. The removal of rock protection, scour protection and cables will result in the increase in suspended sediment within the water column. Although some of the infrastructure may be left in place, such as scour and cable protection, it is likely that the levels of suspended sediments released, will be the same or lower magnitude than those generated during the construction phase of the Offshore Project. It is expected that decommissioning works will be undertaken over the same seasonal restricted window as construction and suspended sediments will take the same amount of time to fall out of suspension as during construction activities. This will likely result in a temporary, localised, adverse and reversible impact. As such, the magnitude of impact is assessed as **Low**. This is because changes to baseline conditions are considered within the range of natural variability.

Sensitivity or value of receptor

11.10.2.4 The high value habitats of annex I bedrock/stoney reef, kelp beds, tide-swept algal communities, offshore subtidal sands and gravels and *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment have been assigned a high ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these habitats to temporary increases in suspended sediments during decommissioning are the same as the sensitivities reported for construction, as detailed in Section 11.8.2 and based on the criteria provided in **Table 11-11**.

11.10.2.5 The low value habitats of Circalittoral mixed sediments and *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment have been assigned a low ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these habitats to temporary increase in suspended solids during decommissioning are the same as the sensitivities reported for construction, as detailed in Section 11.8.2 and based on the criteria provided in **Table 11-11**.

11.10.2.6 Regarding shellfish species, the 4 decapod species, common whelk, the 3 bivalve mollusc species, edible sea urchin and cuttlefish have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these receptors to the temporary increase in SSCs during decommissioning are the same as the sensitivities reported for construction, as detailed in Section 11.8.2 and based on the criteria provided in Section 11.5.3 and **Table 11-11**.

Significance of effect

11.10.2.7 Decommissioning activities are anticipated to generate increased suspended sediments within the eater column. Considering the embedded mitigation described in **Table 11-15**, the effects of the temporary increase in SSCs and turbidity on Benthic and Intertidal Ecology receptors are detailed in **Table 11-34**.

Table 11-34: Significance of effect of temporary increase in suspended sediment concentrations and turbidity to benthic and intertidal ecology receptors during the decommissioning phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Medium	M005, M020	Short-term, direct, reversible, **Minor adverse**	Not significant	Habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. Species recorded within this habitat are adapted to living on bedrock and other hard substrate. This habitat occurs in areas characterised by tidal action, which will reduce the duration of suspended sediments and will re suspend deposited sediments over a short period of time, thus reducing the potential impact.
Kelp beds	Low	High	Medium	M005, M020	Short-term, direct, reversible, **Minor adverse**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Tide-swept algal communities	Low	High	Low	M005, M020	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Offshore subtidal sands and gravels	Negligible	High	Negligible	M005, M020	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Negligible	M005, M020	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Circalittoral mixed sediments	Low	Low	Medium	M005, M020	**Negligible**	Not significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of the UK coastline and not restricted to the Offshore Project Boundary.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Negligible	M005, M020	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Decapod crustaceans	Low	Medium	Low	M005, M020	**Negligible**	Not significant	This species is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary.

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Common whelk	Low	Medium	Low	M005, M020	**Negligible**	Not significant	This species occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Bivalve molluscs	Low	Medium	Low	M005, M020	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years
Edible sea urchin	Low	Medium	Negligible	M005, M020	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years
Cuttlefish	Low	Medium	Negligible	M005, M020	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years
Blue carbon receptors (kelp beds, brittlestar beds).	Low	High	Medium	M005, M020	Short-term, direct, reversible, **Minor adverse**	Not significant	See commentary above for 'kelp beds' and 'brittlestar' beds.

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Further environmental mitigation and residual effects

11.10.2.8 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2) is not significant in EIA terms.

11.10.3 TEMPORARY INCREASE IN SEDIMENT DEPOSITION FROM MOBILISED SEDIMENT

11.10.3.1 Increases in deposition of suspended sediments have the potential to impact Benthic and Intertidal Ecology receptors, through smothering of habitats and sessile organisms, clogging gills, reducing prey availability and causing mobile species such as decapods to relocate which could increase the potential for predation. Habitats and sessile organisms are more likely to be impacted by smothering than mobile species, which are able to avoid areas of increased sediment deposition or to excavate themselves from sediment deposits. The maximum design scenario relating to temporary increase in sediment deposition during the decommissioning phase are presented in **Table 11-14**.

Magnitude

11.10.3.2 Decommissioning activities within the Offshore Project Boundary are expected to follow the reverse of the construction phase of the Offshore Project, with some infrastructure left in place. The removal of rock protection, scour protection and cables will result in the increase SSCs and subsequent sediment deposition. Although some of the infrastructure will be left in place (likely to be scour and cable protection) it is likely that the levels of suspended sediments released and subsequent sediment deposition, will be of the same or lower magnitude than those generated during the construction phase of the Offshore Project. It is expected that decommissioning works will be undertaken over the same seasonal restricted windows (April-October) as construction and suspended sediments will take the same amount of time to fall out of suspension as during construction activities. This will likely result in a short-term, localised, adverse and reversible impact. As such, the magnitude of impact is assessed as **Low**. This is because changes to baseline conditions are considered within the range of natural variability.

Sensitivity or value of receptor

11.10.3.3 The high value habitats of annex I bedrock/stoney reef, kelp beds, tide-swept algal communities, offshore subtidal sands and gravels and *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment have been assigned a high ecological value, based upon criteria determined in Section 11.8.3 of this chapter. The sensitivities of these habitats to temporary increased in sediment deposition during decommissioning are the same as the sensitivities reported for construction, as detailed in Section 11.8.3 and based on the criteria provided in **Table 11-11**.

11.10.3.4 The low value habitats of Circalittoral mixed sediments and *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment have been assigned a low ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these habitats to temporary increase in sediment deposition during decommissioning are the same as the sensitivities reported for construction, as detailed in Section 11.8.30 and based on the criteria provided in **Table 11-11**.

11.10.3.5 Regarding shellfish species, the 4 decapod species, common whelk, the 3 bivalve mollusc species, edible sea urchin and cuttlefish have been assigned a medium ecological value, based upon criteria determined in Section 11.5.3 of this chapter. The sensitivities of these receptors to the temporary increase in sediment deposition during decommissioning are the same as the sensitivities reported for construction, as detailed in Section 11.8.3 and based on the criteria provided in **Table 11-11**.

Significance of effect

11.10.3.6 Decommissioning activities are anticipated to result in increased sediment deposition. However, the tidal conditions and currents within the Offshore Project Boundary are likely to remobilise deposited sediment quickly and reduce the amount of time it is present. Considering the embedded mitigation detailed in **Table 11-15**, the effects of a temporary increase in sediment deposition from mobilised sediment on Benthic and Intertidal Ecology receptors are detailed in **Table 11-35.**

Table 11-35: Significance of effect of temporary increase in sediment deposition to benthic ecology receptors during the decommissioning phase

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
Annex I bedrock and/or stony reef	Low	High	Low	M005, M020	**Negligible**	Not significant	Habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary. This habitat occurs in areas characterised by tidal action, which will reduce the duration of suspended sediments and will re suspend deposited sediments over a short period of time, thus reducing the potential impact.
Kelp beds	Low	High	Low	M005, M020	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Tide-swept algal communities	Low	High	Low	M005, M020	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Offshore subtidal sands and gravels	Low	High	Medium	M005, M020	Short-term, direct, reversible,	Not significant	Offshore subtidal sands and gravels are the most abundant habitat along the majority of the UK

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
					Minor adverse		coastline and not restricted to the Offshore Project Boundary.
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds	Low	High	Medium	M005, M020	Short-term, direct, reversible, **Minor adverse**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Circalittoral mixed sediments	Low	Low	Medium	M005, M020	Short-term, direct, reversible, **Minor adverse**	Not significant	This habitat is present along the coastline of multiple areas around the UK and is not restricted to the Offshore Project Boundary.
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Low	Low	Low	M005, M020	**Negligible**	Not significant	This habitat occurs in areas characterised by tidal action, which will reduce the residency time of suspended sediments and will re suspend deposited sediments over a short period of time and disperse the sediment out of the Study Area, thus reducing the potential impact.
Decapod crustaceans	Low	Medium	Negligible	M005, M020	**Negligible**	Not significant	The short-term nature of the works and the type of sediment deposited (coarse sand and gravels) is likely to reduce the potential for adverse impacts, as coarser sediments have larger

Receptor	Magnitude	Value	Sensitivity	Embedded mitigation measures	Significance of effect	Significance	Commentary
							interstitial spaces, and therefore have more water exchange with the overlying water column, reducing the potential for anoxic conditions.
Common whelk	Low	Medium	Low	M005, M020	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years
Bivalve molluscs	Low	Medium	Negligible	M005, M020	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years
Edible sea urchin	Low	Medium	Low	M005, M020	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years
Cuttlefish	Low	Medium	Negligible	M005, M020	**Negligible**	Not significant	Impact is not anticipated to lead to changes to the population of species. Impact is considered reversible with recovery expected within 5 years
Blue carbon receptors *(kelp beds, brittlestar beds)*	Low	High	Medium	M005, M020	Short-term, direct, reversible, **Minor adverse**	Not significant	See commentary above for 'kelp beds' and 'brittlestar beds'.

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Further environmental mitigation and residual effect

11.10.3.7 No additional benthic and intertidal ecology mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the embedded commitments outlined in Section 11.7.2 is not significant in EIA terms.

11.10.4 OTHER IMPACT PATHWAYS

11.10.4.1 The following impact pathways have been assessed as part of the construction phase:

- Temporary seabed habitat loss and/or disturbance (Section 11.8.1);
- Disturbance from underwater noise and vibration (Section 11.8.4);
- Introduction and colonisation of infrastructure by INNS (Section 11.8.6);
- Potential effects on benthic habitats through fishing restrictions (Section 11.8.7).

11.10.4.2 Activities associated with the maximum design scenario of decommissioning, through the removal of infrastructure (see **Table 11-14**), are expected to occur with no greater (likely lower) intensity than those during construction. As such, construction activities associated with the aforementioned impact pathways are assumed to represent the worst-case-scenario. As such, impacts on the relevant sensitive receptors during decommissioning are not anticipated to result in significant effects.

11.11 ASSESSMENT OF COMBINED EFFECTS

11.11.1.1 The combined effects assessment considers likely significant effects from multiple impacts and activities from the construction, O&M, and decommissioning phases of the Offshore Project on the same receptor, or group of receptors. The overall method following in identifying and assessing potential Combined Effects in relation to the offshore environment is set out in **Chapter 5, Volume 1a**.

11.11.1.2 Combined effects could potentially arise in one of two ways. The first type of combined effect is a Project lifetime effect, where multiple phases of the Offshore Project (construction, O&M, and decommissioning) interact to create a potentially more significant effect on a receptor than in one phase alone.

11.11.1.3 The second type of combined effect is receptor-led effects. Receptor-led effects are where effects from different environmental aspects combine spatially and temporally on a receptor. These effects may be short-term, temporary, transient, or longer-term.

11.11.1.4 Receptor-led effects have been considered, where relevant, in this chapter for potential interactions between Benthic and Intertidal Ecology and the following environmental aspects:

- Fish Ecology;

- Marine Mammals;
- Marine and Nearshore Ornithology.

11.11.1.5 Full results of the Project lifetime effects and receptor-led effects assessment can be found in **Chapter 23: Combined Effects Assessment, Volume 2a**.

11.12 CONSIDERATION OF ONSHORE TRANSMISSION WORKS PROJECT

11.12.1.1 A separate application for the Project's onshore elements (the OTW Project) that includes all infrastructure landwards of MLWS within the Onshore Transmission Works Boundary will be made, under the Town and Country Planning (Scotland) Act 1997 to CnES. The OTW Project EIAR will provide a full description of the onshore elements of the Project landward of MLWS, and include an assessment of the associated likely significant effects.

11.12.1.2 This EIAR has considered the additive interactions between the Offshore Project and OTW Project to understand if there is the potential for any change to the assessment outcomes as a result of both elements of the Project. The approach to identify and consider potential interactions between the Offshore Project and OTW Project is set out in **Chapter 5, Volume 1a** and key design parameters associated with the OTW Project are summarised in **Chapter 3, Volume 1a**.

11.12.1.3 The potential for effects identified in **Table 11-4** to interact with effects associated with the OTW Project on a common receptor included within the benthic and intertidal ecology assessment (i.e. receptors which have the potential to experience effects from both projects) has been considered. However, the ZOI associated with Benthic and Intertidal Ecology is limited spatially to the marine environment and only has the potential to cause an effect on receptors which are in the marine environment. The only activity to occur between MHWS and MLWS is associated with HDD and cable installation that will occur under the seabed. The works above the seabed associated with this (i.e. HDD Exit Pit construction and cable pull through vessel activities) are already considered within this chapter. As the works between MHWS and MLWS are below the seabed there is no potential for impact to Benthic and Intertidal Ecology receptors. Further to this, it has been assumed that there will be negligible impact to onshore rivers/water bodies due to the OTW Project following the incorporation of mitigation measures. For example, this could include the use of HDD techniques for installation of the Onshore Cable through a watercourse. As a result of this, there is no pathway for these effects to interact in addition to the OTW Project and this is not considered further. Following consideration of the OTW Project and likely ZOI and influence on common receptors, there are no pathways that have the potential to effect Benthic and Intertidal Ecology receptors. As a result of this, there is no impact pathway for these effects to interact in addition to the OTW Project and this is not considered further.

11.13 ASSESSMENT OF CUMULATIVE EFFECTS

11.13.1 APPROACH

11.13.1.1 A cumulative effects assessment (CEA) examines the potential for impacts of the Offshore Project in addition with Other Projects (including the OTW Project) on the same single receptor or resource and the contribution of the Offshore Project to those impacts. The overall method following in identifying and assessing potential cumulative effects in relation to the offshore environment is set out in **Chapter 5, Volume 1a**.

11.13.1.2 The offshore screening approach is based on the Planning Inspectorate's Advice Note Nine (Planning Inspectorate, 2018) and Advice Note Seventeen (Planning Inspectorate, 2024), with relevant components of the RenewableUK (RenewableUK, 2013) accepted guidance, which includes aspects specific to the marine elements of an OWF, addressing the need to consider mobile wide-ranging species (foraging species, migratory routes etc).

11.13.1.3 The conclusions of the assessment of the Offshore Project and any additional effect arising from the OTW Project as identified in this chapter have been considered in this CEA. However, given the assumed mitigation and conclusion drawn within Section 11.12 there are no material additional impacts resulting from the OTW Project.

11.13.2 CUMULATIVE EFFECTS ASSESSMENT

11.13.2.1 For Benthic and Intertidal Ecology, a ZOI has been applied based upon the maximum dispersal of suspended sediments generated from construction and operational activities, to ensure direct and indirect cumulative effects can be appropriately identified and assessed. The ZOI has been derived by using the results of the sediment transport model described in **Chapter 9, Volume 2a**, which determined that the maximum distance sediment would be transported would be approximately 6 km from the point of release. The Benthic and Intertidal Ecology ZOI is shown in **Figure 11-1, Volume 2b**.

11.13.2.2 A short list of 'other developments' that may interact with the Project ZOIs during their construction, operation, or decommissioning is presented in **Appendix 5.3: Cumulative effects assessment shortlisted developments, Volume 1c**. This list has been generated applying criteria set out in **Chapter 5, Volume 1a** and has been collated up to the finalisation of the EIA through desk study, consultation, and engagement.

11.13.2.3 Only those 'other developments' in the short list that fall within the Benthic and Intertidal Ecology ZOI have the potential to result in cumulative effects with the Offshore Project on Benthic and Intertidal Ecology. All 'other developments' falling outside the Benthic and Intertidal Ecology ZOI are excluded from this assessment.

11.13.2.4 There are no ‘other developments’ within the Benthic and Intertidal Ecology ZOI and on this basis there are no ‘other developments’ that are scoped into the Benthic and Intertidal Ecology CEA, as the nearest development is 40 km from the Benthic and Intertidal Ecology ZOI. Further justification for this screening outcome is based upon the sessile nature/low mobility of species and habitats that fall under the Benthic and Intertidal Ecology assessment, thus reducing the potential for cumulative impacts from ‘other developments’.

11.14 TRANSBOUNDARY EFFECTS

11.14.1.1 Transboundary effects occur when a development in 1 European Economic Area (EEA) State impacts the environment of another EEA State(s). A screening of potential transboundary effects was undertaken within the Scoping Report (Spiorad na Mara Limited, 2023).

11.14.1.2 Based on the knowledge of the baseline environment, the nature of planned works and the wealth of evidence on the potential for impacts from such projects more widely, there are not considered to be any transboundary effects on benthic, epibenthic and intertidal ecology receptors from the Offshore Project.

11.14.1.3 Furthermore, in relation to transboundary impacts, the Scottish Ministers are content for the impacts to Benthic and Intertidal Ecology receptors to be scoped out of the EIAR for Benthic and Intertidal Ecology.

11.15 SUMMARY OF RESIDUAL EFFECTS

11.15.1.1 **Table 11-36** presents a summary of the assessment of significant impacts, any relevant mitigation measures, and residual effects on Benthic and Intertidal Ecology receptors.

11.15.1.2 This assessment concludes that no significant effects upon any identified receptors are expected. As such, there are no anticipated effects that risk undermining the conservation objectives of PMFs.

Table 11-36 Summary of residual effects

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
Construction							
Temporary Habitat Loss and/or Disturbance	Kelp beds	Low	V- High S- Medium	M001, M002, M005, M054	Short-term, direct, reversible, **Minor adverse** (Not significant)	N/A	Short-term, direct, reversible, **Minor adverse** (Not significant)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Medium				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Medium				
	Common whelk		V- Medium S- Medium				
	Bivalve molluscs		V- Medium S- Medium				
	Cuttlefish		V- Medium S- Medium				
	Blue carbon receptors		V- High S- Medium				
	Annex I Bedrock and/or Stony Reef		V- High S- Low	M001, M002, M005, M054	**Negligible** (Not significant)	N/A	**Negligible** (Not significant)
	Tide-swept algal communities		V- High S- Low				
	Decapod crustaceans		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Low				
	Offshore subtidal sands and gravels	Negligible	V- High S- Medium	M001, M002, M005, M054	**Negligible** (Not significant)	N/A	**Negligible** (Not significant)
	Circalittoral mixed sediments		V- Low S- Medium				
Temporary increase in SSC and Turbidity	Annex I Bedrock and/or Stony Reef	Low	V- High S- Medium	M005	Short-term, direct, reversible, **Minor adverse** (Not significant)	N/A	Short-term, direct, reversible, **Minor adverse** (Not significant)

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Kelp beds		V- High S- Medium				
	Blue carbon receptors		V- High S- Medium				
	Tide-swept algal communities	Low	V- High S- Low	M005	**Negligible** (Not significant)	N/A	**Negligible** (Not significant)
	Decapod crustaceans		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Negligible				
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Low				
	Cuttlefish		V- Medium S- Negligible				
	Offshore subtidal sands and gravels	Negligible	V- High S- Negligible	M005	**Negligible** (Not significant)	N/A	**Negligible** (Not significant)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Negligible				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Negligible				
	Circalittoral mixed sediments		V- Low S- Medium				
Temporary increase in sediment deposition	Offshore subtidal sands and gravels	Low	V- High S- Medium	M005	Short-term, direct, reversible, **Minor adverse** (Not significant)	N/A	Short-term, direct, reversible, **Minor adverse** (Not significant)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Medium				
	Circalittoral mixed sediments		V- Low S- Medium				
	Blue carbon receptors		V- High S- Medium				
	Annex I Bedrock and/or Stony Reef	Low	V- High S- Low	M005	**Negligible** (Not significant)	N/A	N/A

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Kelp beds		V- High S- Low				
	Tide-swept algal communities		V- High S- Low				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Low				
	Decapod crustaceans		V- Medium S- Negligible				
	Edible sea urchin		V- Medium S- Low				
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Negligible				
	Cuttlefish		V- Medium S- Negligible				
Disturbance from underwater noise and Vibration generated during Piling and cable route preparation	Decapod crustaceans	Low	V- Medium S- Medium	M003	Medium-term, direct, reversible, **Minor adverse** (Not significant)	N/A	Medium-term, direct, reversible, **Minor adverse** (Not significant)
	Cuttlefish		V- Medium S- Medium				
	Edible sea urchin	Low	V- Medium S- Negligible	M003	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Low				
Release of drilling fluid mud, drilling arising or bentonite from HDD employed at the cable landfall location	Annex I Bedrock and/or Stony Reef	Low	V- High S- Medium	M004	Short-term, direct, reversible, **Minor adverse** (Not significant)	N/A	Short-term, direct, reversible, **Minor adverse** (Not significant)
	Kelp beds		V- High S- Medium				

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Tide-swept algal communities	Low	V- High S- Low	M004	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Negligible				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Negligible				
	Decapod crustaceans		V- Medium S- Low				
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Negligible				
	Cuttlefish		V- Medium S- Negligible				
	Offshore subtidal sands and gravels	Negligible	V- High S- Negligible	M004	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Circalittoral mixed sediments		V- Low S- Medium				
Introduction and colonisation by INNS	Offshore subtidal sands and gravels	Low	V- High S- Medium	M006	Long-term, non-reversible, indirect, adverse, **Minor adverse** (Not significant)	N/A	Long-term, non-reversible, indirect, adverse, **Minor adverse** (Not significant)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Medium				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Medium				
	Circalittoral mixed sediments		V- Low S- High				
	Annex I Bedrock and/or Stony Reef		V- High S- Negligible	M006	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Kelp beds		V- High S- Negligible				

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Tide-swept algal communities		V- High S- Low				
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Negligible				
	Cuttlefish		V- Medium S- Low				
	Decapod crustaceans	Negligible	V- Medium S- Negligible	M006	**Negligible**- Not significant	N/A	**Negligible**- Not significant
Potential effects on benthic habitats through fishing restrictions	Kelp beds	Low	V- High S- Medium	N/A	Short-term, direct, reversible, **Minor beneficial** (Not significant)	N/A	Short-term, direct, reversible, **Minor beneficial** (Not significant)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Medium				
	Circalittoral mixed sediments		V- Low S- Medium				
	Common whelk		V- Medium S- Medium				
	Bivalve molluscs		V- Medium S- Medium				
	Cuttlefish		V- Medium S- Medium				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Medium				
	Annex I Bedrock and/or Stony Reef		V- High S- Low		**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Tide-swept algal communities		V- High S- Low				
	Offshore subtidal sands and gravels		V- High S- Medium				

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Decapod crustaceans		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Low				
Operation and Maintenance							
Long-term loss of habitat	Annex I Bedrock and/or Stony Reef	Low	V- High S- Medium	M001, M002, M025	Long-term-, direct, non-reversible, **Minor adverse** (Not significant)	N/A	Long-term-, direct, non-reversible, **Minor adverse** (Not significant)
	Kelp beds		V- High S- High				
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- High				
	Circalittoral mixed sediments		V- Low S- High				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- High				
	Decapod crustaceans		V- Low S- Medium				
	Bivalve molluscs		V- Medium S- Medium				
	Edible sea urchin		V- Medium S- Medium				
	Cuttlefish		V- Medium S- Medium				
	Blue carbon receptors		V- High S- High				
	Tide-swept algal communities		V- High S- Low		**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Common whelk		V- Medium S- Negligible				
	Offshore subtidal sands and gravels	Negligible	V- High S- High		**Negligible**- Not significant	N/A	**Negligible**- Not significant

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
Long-term habitat disturbance	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds	Low	V- High S- Medium	M001, M002, M025	Long-term, direct, reversible, **Minor adverse** (Not significant)	N/A	Long-term, direct, reversible, **Minor adverse**(Not significant)
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Medium				
	Common whelk		V- Medium S- Medium				
	Bivalve molluscs		V- Medium S- Medium				
	Cuttlefish		V- Medium S- Medium				
	Annex I Bedrock and/or Stony Reef	Low	V- High S- Low	M001, M002, M025	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Kelp beds		V- High S- Medium				
	Tide-swept algal communities		V- High S- Low				
	Decapod crustaceans		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Low				
	Offshore subtidal sands and gravels	Negligible	V- High S- Medium	M001, M002, M025	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Circalittoral mixed sediments		V- Low S- Medium				
Temporary Habitat Loss and/or Disturbance	Kelp beds	Low	V- High S- Medium	M001, M002, M005, M025, M054	Short-term, direct, reversible, **Minor adverse**- (Not significant)	N/A	Short-term, direct, reversible, **Minor adverse**- (Not significant)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Medium				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Medium				
	Common whelk		V- Medium S- Medium				

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Bivalve molluscs		V- Medium S- Medium				
	Cuttlefish		V- Medium S- Medium				
	Blue Carbon Receptors		V- High S- Medium				
	Annex I Bedrock and/or Stony Reef		V- High S- Low	M001, M002, M005, M025, M054	**Negligible**- (Not significant)	N/A	**Negligible**- (Not significant)
	Tide-swept algal communities		V- High S- Low				
	Decapod crustaceans		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Low				
	Offshore subtidal sands and gravels	Negligible	V- Medium S- Medium	M001, M002, M005, M025, M054	**Negligible-** (Not significant)	N/A	**Negligible-** (Not significant)
	Circalittoral mixed sediments		V- Low S- Medium				
Temporary increases in SSCs and turbidity	Annex I Bedrock and/or Stony Reef	Low	V- High S- Medium	M005, M025	Long-term, direct, reversible, **Minor adverse** – Not significant.	N/A	Long-term, direct, reversible, **Minor adverse** – Not significant.
	Kelp beds		V- High S- Medium				
	Circalittoral mixed sediments		V- Low S- Medium				
	Blue carbon receptors		V- High S- Medium				
	Tide-swept algal communities		V- High S- Low	M005, M025	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Offshore subtidal sands and gravels		V- Medium S- Negligible				

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Negligible				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Negligible				
	Decapod crustaceans		V- Medium S- Low				
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Negligible				
	Cuttlefish		V- Medium S- Negligible				
Temporary increases in sediment deposition	Offshore subtidal sands and gravels		V- High S- Medium	M005, M025	Long-term, direct, reversible, **Minor adverse** (Not significant)	N/A	Long-term, direct, reversible, **Minor adverse** (Not significant)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Medium				
	Circalittoral mixed sediments		V- Low S- Medium				
	Blue carbon receptors		V- High S- Medium				
	Annex I Bedrock and/or Stony Reef	Low	V- High S- Low	M005, M025	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Kelp beds		V- High S- Low				
	Tide-swept algal communities		V- High S- Low				
	Decapod crustaceans		V- Medium S- Negligible				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Medium				
	Common whelk		V- Medium S- Low				

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Bivalve molluscs		V- Medium S- Negligible				
	Edible sea urchin		V- Medium S- Low				
	Cuttlefish		V- Medium S- Negligible				
Introduction and colonisation by INNS	Offshore subtidal sands and gravels	Low	V- High S- Medium	M005, M025	Long-term, non-reversible, indirect **Minor adverse** – Not significant	N/A	Long-term, non-reversible, indirect **Minor adverse** – Not significant
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Medium				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Medium				
	Circalittoral mixed sediments		V- Low S- High				
	Kelp beds	Low	V- High S- Negligible	M006	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Tide-swept algal communities		V- High S- Low				
	Decapod crustaceans		V- Medium S- Negligible				
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Negligible				
	Cuttlefish		V- Medium S- Low				
	Annex I Bedrock and/or Stony Reef		V- High S- Negligible				
EMF effects from subsea electrical cables	Annex I Bedrock and/or Stony Reef	Low	V- High S- Negligible	M002	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Kelp beds		V- High S- Negligible				
	Tide-swept algal communities		V- High S- Negligible				

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Offshore subtidal sands and gravels		V- High S- Negligible				
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Negligible				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Negligible				
	Circalittoral mixed sediments		V- Low S- Negligible				
	Decapod crustaceans		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Negligible				
	Common whelk		V- Medium S- Negligible				
	Bivalve molluscs		V- Medium S- Negligible				
	Cuttlefish		V- Medium S- Low				
Thermal emissions from subsea electrical cables	Annex I Bedrock and/or Stony Reef	Low	V- High S- Low	M002	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Offshore subtidal sands and gravels		V- High S- Low				
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Negligible				
	Circalittoral mixed sediments		V- Low S- Low				
	Decapod crustaceans		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Low				
	Kelp beds	Negligible	V- High S- Medium	M002	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Tide-swept algal communities		V- High S- Low				

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediments		V- Low S- Negligible				
	Common whelk		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Low				
	Cuttlefish		V- Medium S- Medium				
Decommissioning							
Removal of infrastructure following decommissioning of the Offshore Project	Annex I Bedrock and/or Stony Reef	Low	V- High S- High	M020	Long-term, direct, reversible, **Minor adverse** – Not significant	N/A	Long-term, direct, reversible, **Minor adverse** – Not significant
	Edible sea urchin	Low	V- Medium S- Low - Medium	M020	Long-term, direct, reversible, **Minor beneficial** – Not significant	N/A	Long-term, direct, reversible, **Minor beneficial** – Not significant
	Offshore subtidal sands and gravels		V- High S- High				
	Circalittoral mixed sediments		V- Low S- High				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- High				
	Decapod crustaceans		V- Medium S- Low -Medium				
	Bivalve molluscs		V- Medium S- Low - Medium				
	Cuttlefish		V- Medium S- Low - Medium				
	Tide-swept algal communities	Low	V- High S- Low	M020	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Negligible				
	Common whelk		V- Medium S- Negligible				
	Kelp beds	Negligible	V- High S- High	M020	**Negligible**- Not significant	N/A	**Negligible**- Not significant

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
Temporary increase in sediment concentrations and turbidity	Annex I Bedrock and/or Stony Reef	Low	V- High S- Medium	M005, M020	Short-term, direct, reversible, **Minor adverse** – Not significant	N/A	Short-term, direct, reversible, **Minor adverse** – Not significant
	Kelp beds		V- High S- Medium				
	Blue carbon receptors		V- High S- Medium				
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Negligible	M005, M020	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Tide-swept algal communities		V- High S- Low				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Negligible				
	Circalittoral mixed sediments		V- Low S- Medium				
	Decapod crustaceans		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Negligible				
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Low				
	Cuttlefish		V- Medium S- Negligible				
	Offshore subtidal sands and gravels	Negligible	V- Medium S- Negligible	M005, M020	**Negligible**- Not significant	N/A	**Negligible**- Not significant
Temporary increase in sediment deposition	Offshore subtidal sands and gravels	Low	V- High S- Medium	M005, M020	Short-term, direct, reversible, **Minor adverse** – Not significant	N/A	Short-term, direct, reversible, **Minor adverse** – Not significant
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Medium				

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Blue carbon receptors		V- High S- Medium				
	Annex I Bedrock and/or Stony Reef		V- High S- Low	M005, M020	**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Kelp beds		V- High S- Low				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Low				
	Circalittoral mixed sediments		V- Low S- Medium				
	Tide-swept algal communities		V- High S- Low				
	Decapod crustaceans		V- Medium S- Negligible				
	Edible sea urchin		V- Medium S- Low				
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Negligible				
	Cuttlefish		V- Medium S- Negligible				
	Annex I Bedrock and/or Stony Reef		V- High S- Medium				
Temporary seabed habitat loss and/or disturbance	Kelp beds	Low	V- High S- Medium	M001, M002, M005, M054	Short-term, direct, reversible, **Minor adverse** (Not significant)	N/A	Short-term, direct, reversible, **Minor adverse** (Not significant)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V – High S - Medium				
	Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment		V – Low S - Medium				
	Common Whelk		V – Medium S - Medium				
	Bivalve molluscs		V – Medium S - Medium				
	Cuttlefish		V – Medium S - Medium				
	Blue Carbon Receptors		V – High S - Medium				
	Annex I Bedrock and/or Stony Reef		V – High S - Low		**Negligible**- Not significant	N/A	**Negligible**- Not significant

Activity and impact	Receptor	Magnitude of impact	Receptor sensitivity (S) or value (V)	Embedded mitigation measures	Significance of effect (significance)	Further environmental mitigation	Significance of residual effect (significance)
	Tide-swept algal communities		V – High S - Low				
	Decapod crustaceans		V – Medium S - Low				
	Edible sea urchin		V – Medium S - Low				
	Circalittoral mixed sediments	Negligible	V – Low S - Medium		**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Offshore subtidal sands and gravels		V – High S - Medium				
Disturbance from underwater noise and Vibration	Decapod crustaceans	Low	V- Medium S- Medium	M003	Medium-term, direct, reversible, **Minor adverse** (Not significant)	N/A	Medium-term, direct, reversible, **Minor adverse** (Not significant)
	Cuttlefish		V- Medium S- Medium				
	Edible sea urchin		V- Medium S- Negligible		**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Low				
Introduction and colonisation by INNS	Offshore subtidal sands and gravels	Low	V- High S- Medium	M006	Long-term, non-reversible, indirect, adverse, **Minor adverse** (Not significant)	N/A	Long-term, non-reversible, indirect, adverse, **Minor adverse** (Not significant)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Medium				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Medium				
	Circalittoral mixed sediments		V- Low S- High				
	Annex I Bedrock and/or Stony Reef		V- High S- Negligible		**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Tide-swept algal communities		V- High S- Low				
	Decapod crustaceans		V- Medium S- Negligible				
	Common whelk		V- Medium S- Low				
	Bivalve molluscs		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Negligible				
	Cuttlefish		V- Medium				

Activity and impact	**Receptor**	**Magnitude of impact**	**Receptor sensitivity (S) or value (V)**	**Embedded mitigation measures**	**Significance of effect (significance)**	**Further environmental mitigation**	**Significance of residual effect (significance)**
			S- Low				
	Annex I Bedrock and/or Stony Reef		V- High S- Negligible				
	Decapod Crustaceans	Negligible	V- Medium S- Negligible	M006	**Negligible**- Not significant	N/A	**Negligible**- Not significant
Potential effects on benthic habitats through fishing restrictions	Kelp Beds	Low	V- High S- Medium		Short-term, direct, reversible, **Minor beneficial** (Not significant)	N/A	Short-term, direct, reversible, **Minor beneficial** (Not significant)
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds		V- High S- Medium				
	Circalittoral mixed sediments		V- Low S- Medium				
	Common whelk		V- Medium S- Medium				
	Bivalve molluscs		V- Medium S- Medium				
	Cuttlefish		V- Medium S- Medium				
	Flustra foliacea and *Hydrallmania falcata* on Tide-swept circalittoral mixed sediment		V- Low S- Medium				
	Annex I Bedrock and/or Stony Reef		V- High S- Low		**Negligible**- Not significant	N/A	**Negligible**- Not significant
	Tide-swept algal communities		V- High S- Low				
	Offshore subtidal sands and gravels		V- High S- Low				
	Decapod crustaceans		V- Medium S- Low				
	Edible sea urchin		V- Medium S- Low				

11.16 GLOSSARY OF TERMS AND ABBREVIATIONS

11.16.1.1 A list of key terms and acronyms used in this chapter are provided in **Table 11-37** and **Table 11-38.**

Table 11-37 Acronyms and abbreviations

Term	Definition
AC	Alternating Current
BACI	Before-After-Control-Impact
BAP	Biodiversity Action Plan
BRUV	Baited Remote Underwater Video
BSH	Broadscale Habitats
CBRA	Cable Burial Risk Assessment
CEA	Cumulative Effects Assessment
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute for Ecology and Environmental Management
CnES	Comhairle nan Eilean Siar
DDC	Drop-down camera
EBS	Environmental Baseline Survey
eDNA	Environmental Deoxyribonucleic Acid
EEA	European Economic Area
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic field
EMODnet	European Marine Observation and Data Network
EMP	Environmental Management Plan
EPS	European Protected Species
EU	European Union
EUNIS	European Nature Information System
FeAST	Feature Activity Sensitivity Tool
GeMs	Geodatabase of marine features adjacent to Scotland/*Alba*
GEN	General Policy
GES	Good Environmental Status
HDD	Horizontal Directional Drilling
HGB	Hybrid Gravity Base
HPI	Habitats of Principal Importance
HVAC	High Voltage Alternating Current
ICES	International Council for the Exploration of the Sea
IEF	Important Ecological Feature
iE-fields	Induced Electric Field
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee

Term	Definition
LAT	Lowest Astronomical Tide
MarESA	Marine Evidence-based Sensitivity Assessment
MarLIN	Marine Life Information Network
MARPOL	International Convention for the Prevention of Pollution from Ships
MD-LOT	Marine Directorate Licensing Operations Team
MD-SEDD	Marine Directorate – Science Evidence Data and Digital
MHWS	Mean High Water Spring
MLWS	Mean Low Water Spring
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MPA	Marine Protected Area
MSL	Mean Sea Level
MSS	Marine Directorate Science
NMP	National Marine Plan
NRW	Natural Resources Wales
OCAS	Offshore Cable Area of Search
O&M	Operation and Maintenance
OEMP	Offshore Environmental Management Plan
OSP	Offshore Substation Platform
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
OTW	Onshore Transmission Works
OWF	Offshore Wind Farm
PAC	Preliminary Application Consultation
PMF	Priority Marine Feature
PSD	Particle Size Distribution
RIAA	Report to Inform Appropriate Assessment
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SFF	Scottish Fishermen’s Federation
SNH	Scottish Natural Heritage
SO	Strategic objectives
SOE	Safety and Oil Environmental
SSC	Suspended Sediment Concentration
UAV	Unmanned Aerial Vehicle
UK	United Kingdom
WEWS	Water Environment and Water Services
WFD	Water Framework Directive
WTG	Wind Turbine Generator
ZOI	Zone of Influence

Table 11-38 Glossary

Term	Meaning
Array Area	The offshore area within which the offshore wind turbine generators (WTGs), associated foundations, Offshore Cables, and Offshore Substation Platform (OSP) (if required), will be located. This area encompasses the Turbine Area that will contain all above water surface infrastructure (WTGs/OSP) and an additional area within which further below water infrastructure (foundations and cables) may also be located.
Annex I reef	Refers to a marine habitat listed under Habitat 1170 of the EU Habitats Directive (92/43/EEC). Hard compact substrata on solid and soft bottoms, which arise from the sea floor in sublittoral and littoral zones.
Biogenic reef	Created by living organisms
Epifauna	Animals living on the seabed.
Geogenic reef	Refers to a reef that has developed naturally over time through geological processes, without significant biological contribution.
Offshore Cable Area of Search (OCAS)	The area within which the offshore cable infrastructure between the Array Area and Landfall up to Mean High Water Springs (MHWS) will be located.
Offshore Project	The components of the Spiorad na Mara offshore wind farm (the Project) located seaward of Mean High Water Springs (MHWS).
International Council for the Exploration of the Sea (ICES) statistical rectangles	The (ICES) standardises the division of sea areas to enable statistical analyses of data. Each ICES statistical rectangle is '30 min latitude by 1 degree longitude' in size (i.e. approximately 30 x 30 nautical miles). A number of rectangles are amalgamated to create ICES statistical areas.
Infauna	Benthic organisms that inhabit the sediments of the seafloor, living within or partially within the substrate.
Resilience	The capacity of systems and its component to anticipate and cope with a hazardous event or trend or disturbance, and accommodate, or recover from the effects of a hazardous event or trend in a timely and efficient manner.
Resistance	Indicates whether a receptor can absorb disturbance or stress without changing character.
Sediment transport	This term refers to the movement of sediment (e.g. sand, silt, gravel, and particulate organic matter) that occurs when bed shear stress exceeds the threshold for sediment suspension. This is typically caused by wave and current action and can be influenced by the presence of structures in the marine environment. Sediment transport can occur in localised or widespread areas, and it can be short-term or relate to longer term erosion/accretion processes.
Shellfish	Aquatic invertebrates characterised by an external shell or shell-like exoskeleton. They are commonly divided into 2 primary groups: molluscs and crustaceans.
Tidal excursion	The net horizontal distance that a water particle travels due to tidal currents between low-water slack tide and high-water slack tide.

Term	**Meaning**
Zone of Influence	The spatial area within which project activities may cause ecological effects to receptors.

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